Government of Kerala
1984

Reg. No. KL/TV(N)/12

# KERALA GAZETTE

## EXTRAORDINARY

## PUBLISHED BY AUTHORITY

Vol. XXIX] Trivandrum, Thursday, 25th October 1984 / 3rd Karthika 1906 [No. 914

## SECRETARIAT OF THE KERALA LEGISLATURE

### NOTIFICATION

No. 9788/LA. 4A/84. *Dated, Trivandrum, 25th October, 1984.*

The Kerala Tolls (Amendment) Bill, 1984 together with the Statement of Objects and Reasons, the Financial Memorandum and the Memorandum regarding Deligated Legislation is published, under Rule 69 of the Rules of Procedure and Conduct of Business in the Kerala Legislative Assembly.

K. P. PADMANABHAN,
*Secretary,*
*Legislative Assembly.*

PRINTED AND PUBLISHED BY THE S. G. P. AT THE GOVERNMENT PRESS, TRIVANDRUM, 1984.

33/4382/MC.

**Seventh Kerala Legislative Assembly**

**Bill No. 129**

# THE KERALA TOLLS (AMENDMENT) BILL, 1984

*A*

*BILL*

*to amend the Kerala Tolls Act, 1976.*

*Preamble.*—WHEREAS it is expedient to amend the Kerala Tolls Act, 1976, for the purposes hereinafter appearing;

BE it enacted in the Thirty-fifth Year of the Republic of India as follows:—

1. *Short title.*—This Act may be called the Kerala Tolls (Amendment) Act, 1984.

2. *Amendment of section 2.*—In section 2 of the Kerala Tolls Act, 1976 (6 of 1977) (hereinafter referred to as the principal Act), in clause (a), for the words "fifteen lakhs rupees", the words "twenty-five lakhs rupees" shall be substituted.

3. *Amendment of section 3.*—In section 3 of the principal Act,—

(1) in sub-section (1), for the figures, letters and words "1st day of January, 1976", the figures, letters and words "1st day of July, 1983" shall be substituted.

(2) to sub-section (1), the following proviso shall be added, namely:—

"Provided that if the Government are of opinion that it is necessary in the public interest so to do, they may, by notification in the Gazette, specify any bridge in respect of which no toll shall be leviable under this sub-section.".

4. *Repeal and saving.*—(1) The Kerala Tolls (Amendment) Ordinance, 1984 (45 of 1984), is hereby repealed.

(2) Notwithstanding such repeal, anything done or deemed to have been done or any action taken or deemed to have been taken under the principal Act as amended by the said Ordinance shall be deemed to have been done or taken under the principal Act as amended by sub-section (2) of section 3 of this Act, as if that sub-section had come into force on the 23rd day of November, 1983.

## STATEMENT OF OBJECTS AND REASONS

Sub-section (1) of section 3 of the Kerala Tolls Act, 1976 (6 of 1977), provides that the Government may levy a toll on every motor vehicle entering a bridge constructed wholly or partly at the expense of the Government and declared open for traffic after the 1st day of January, 1976. A number of representations against the collection of toll on motor vehicles passing over the Calicut Railway Overbridge were received. Collection of toll on motor vehicles passing over a Railway Overbridge in a busy city like Calicut will not only put the public to a lot of inconvenience but also may result in traffic blockade. Arranging for collection of toll on the overbridge at Calicut without causing much inconvenience to the public was impracticable also. Therefore, it was considered necessary to amend sub-section (1) of section 3 of the Kerala Tolls Act, 1976, enabling the Government to exempt collection of toll in respect of any bridge in the public interest.

2. As the Legislative Assembly was not in session and as immediate action in the matter was considered necessary, the Kerala Tolls (Amendment) Ordinance, 1983 (41 of 1983), was promulgated by the Governor on the 23rd day of November, 1983. Though a Bill to replace Ordinance 41 of 1983 by an Act of the Legislature was published, the same could not be introduced in, and passed by, the Legislative Assembly during its session which commenced on the 25th day of November, 1983 and ended on the 20th day of December, 1983. To keep alive the provisions of Ordinance 41 of 1983, the Governor promulgated the Kerala Tolls (Amendment) Ordinance, 1984 (10 of 1984), on the 5th day of January, 1984. A Bill to replace Ordinance 10 of 1984 could not be introduced in, and passed by, the Legislative Assembly during its session which commenced on the 2nd day of March, 1984 and ended on the 27th day of March, 1984. To keep alive the provisions of Ordinance 10 of 1984, the Governor promulgated the Kerala Tolls (Amendment) Ordinance, 1984 (23 of 1984), on the 10th day of April, 1984. A Bill to replace Ordinance 23 of 1984 could not be introduced in, and passed by, the Legislative Assembly during its session which commenced on the 18th day of June, 1984 and ended on the 27th day of July, 1984. To keep alive the provisions of Ordinance 23 of 1984, the Governor promulgated the Kerala Tolls (Amendment) Ordinance, 1984 (45 of 1984), on the 28th day of July, 1984.

3. According to sub-section (1) of section 3 of the Kerala Tolls Act, 1976 (6 of 1977), read with clause (a) of section 2 thereof, the Government may levy a toll on every motor vehicle entering a bridge constructed wholly or partly at the expense of the State Government and declared open for traffic after the 1st day of January, 1976, if the cost of its construction is not less than Rs. 15 lakhs. According to sub-section (1) of section 7 of the National Highways Act, 1956, as amended by the National Highways (Amendment) Act, 1977, in the case of permanent bridges on national highways, fees for services or benefits rendered in relation to the use of such bridges shall be leviable by the Central Government at such rates as may be laid down by rules made in this behalf only if cost of construction of such a bridge is more than

rupees twenty-five lakhs and which is opened to traffic on or after the 1st day of April, 1976. It is considered desirable to have a uniform standard for bridges on State Highways and National Highways in the matter of levy of toll. Government have therefore decided that the minimum cost of the bridges for which toll may be levied be fixed at Rs. 25 lakhs as in the case of bridges on National Highways by amending the Act.

4. The Kerala Tolls Act, 1976, was brought into force on the 22nd day of July, 1983. The Kerala Tolls Levy Rules, 1983, issued under the Act also came into force on the same day on which the Act came into force. It was, therefore, decided that the collection of toll may be made only on bridges opened on or after the 1st July, 1983.

5. The Bill seeks to replace Ordinance 45 of 1984 with the above modifications.

## FINANCIAL MEMORANDUM

The Bill, if enacted and brought into operation would not involve any expenditure from the Consolidated Fund of the State.

## MEMORANDUM REGARDING DELEGATED LEGISLATION

The new proviso proposed to be added to sub-section (1) of section 3 of the Kerala Tolls Act, 1976, by clause 3 of the Bill seeks to empower the Government to specify, by notification in the Gazette, any bridge in respect of which no toll shall be leviable under sub-section (1) of section 3 of the Act.

The matter in respect of which notification may be issued is a matter of administrative nature. The delegation of legislative power is, therefore, of a normal character.

K. AVUKADERKUTTY NAHA

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Reg. No. KL/TV(N)/12

# KERALA GAZETTE

## EXTRAORDINARY

### PUBLISHED BY AUTHORITY

**Vol. XXIX] Trivandrum, Thursday, 25th October 1984 / 3rd Karthika 1906 [No. 913 (Saka)**

## GOVERNMENT OF KERALA

**Revenue (F) Department**

## NOTIFICATION

G. O. (Ms.) No. 1058/84/RD. *Dated, Trivandrum, 25th October* 1984

**S. R. O. No. 1295/84**—In exercise of the powers confered by section 43 of the Kerala Weights and Measures (Enforcement) Act, 1958, (45 of 1958), the Government of Kerala hereby make the following rules to amend the Kerala Weights and Measures (Enforcement) Rules, 1964, the same having been previously published as required by sub-section (4) of the said section, namely :—

## RULES

*Short title and commencement*.—(1) These rules may be called the Kerala Weights and Measures (Enforcement) Amendment Rules, 1984.

(2) They shall come into force with effect from the 1st day of November, 1984.

2. *Amendment of the rules.*—In the Kerala Weights and Measures (Enforcement) Rules, 1964, (1) in rule 9, in sub rules (1) and (2) and in the proviso, for the words and figures "in Schedules V and VI", the words and figures "in Schedules V, VI and VI-A" shall be substituted;

(2) in rule 13, for the words and figures "in Schedule IX" the words, figures and letter "in Schedules IX and IXA" shall be substituted;

(3) in rule 15, for the words and figures "in Schedules IV, V and VI", the words, figures and letter "in Schedules IV, V, VI and VI-A" shall be substituted;

(4) in rule 21 in clause (a) of subrule (1), for the words and figures "in Schedules IV, V and VI", the words, figures and letter "in Schedules IV, V, VI and VI-A" shall be substituted;

(5) **in Schedule IV.—**

(A) **for Part II, the following Part shall be substituted, namely.—**

"PART II

## CARAT WEIGHTS

1. **General :**

This Part deals with the requirements for carat weights intended for use in weighing pearls, diamonds and other precious stones.

2. **Denominations**

The denominations of carat weights shall be as given below (the gram and milligram equivalents are shown against each for ready reference):

(a) *Knob Weights*

| Denominations Carat | Equivalent g |
|---|---|
| 500 | 100 |
| 200 | 40 |
| 100 | 20 |
| 50 | 10 |
| 20 | 4 |
| 10 | 2 |
| 5 | 1 |

(b) *Sheet Metal Weights*

| Denominations Carat | Equivalent mg |
|---|---|
| 1 | 2 |
| 2 | 400 |
| 1 | 200 |
| 50/100 | 100 |
| 20/100 | 40 |
| 10/100 | 20 |
| 5/100 | 10 |
| 2/100 | 4 |
| 1/100 | 2 |
| 0.5/100 | 1 |

3. **Knob Weights:**

(a) *Materials:*

(i) The weights shall be made from rolled, drawn or extruded material and shall not be cast.

(ii) The weights shall be made from brass, bronze, nickel—chromium or non-magnetic stainless steel.

(b) *Shape and Dimensions.*—The shape and dimensions of the weights shall be as shown in Fig. 1 and Table 1.

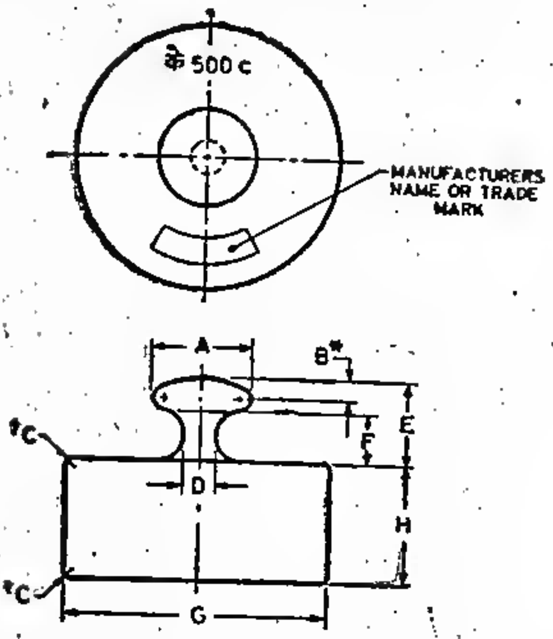



Fig 1—KNOB CARAT WEIGHTS

(c) *Permissible Errors*

| Denomination | Verification | Inspection | |
|---|---|---|---|
| | Errors in excess only | Excess | Deficiency |
| Carat | mg | | mg |
| 500 | 8.0 | same as on verification. | 4.0 |
| 200 | 6.0 | | 3.0 |
| 100 | 5.0 | | 2.5 |
| 50 | 4.0 | | 2.0 |
| 20 | 3.0 | | 1.5 |
| 10 | 2.0 | | 1.0 |
| 5 | 1.0 | | 0.5 |

**4. Sheet Metal Weights :**

(a) *Materials*:—Weights of denominations 2/100 carat and below shall be made of aluminium sheet. Weights of higher denominations shall be made of sheets of brass, aluminium, nickel-silver, nickel-chromium or bronze.

(b) *Shape and Dimensions*:—Sheet metal weights shall be square with a raised corner to facilitate manipulation (Fig. 2). They shall have the dimensions given in Table 2.

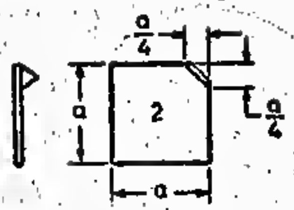



Fig. 2—SHEET METAL WEIGH

TABLE—1
NOMINAL DIMENSIONS FOR KNOB
CARAT WEIGHTS
[Clause 3 (b)]

All dimensions in millimetres

| Denomination Carat | A* | C** | D | E | F | G | H |
|---|---|---|---|---|---|---|---|
| 500 | 12.0 | 0.4 | 4.0 | 10.0 | 6.0 | 32.0 | 14.2 |
| 200 | 10.0 | 0.4 | 3.0 | 8.5 | 5.0 | 23.0 | 10.8 |
| 100 | 8.0 | 0.4 | 2.5 | 7.0 | 4.0 | 19.0 | 7.9 |
| 50 | 6.0 | 0.3 | 2.0 | 5.5 | 3.0 | 15.0 | 6.4 |
| 20 | 5.0 | 0.3 | 2.0 | 4.0 | 2.0 | 11.0 | 4.6 |
| 10 | 4.0 | 0.3 | 1.5 | 3.0 | 1.5 | 9.0 | 3.5 |
| 5 | 3.0 | 0.2 | 1.5 | 2.5 | 1.5 | 7.0 | 2.9 |

*Note*:—With a material of density 8.4g/cm$^3$ (exactly) the above dimensions will give weights which possess masses to within the required tolerance limits on the plus side (this ensures a longer life for the weights). However as the density of the material may vary considerably as also the manufacturing techniques, a tolerance of $\pm 5$ per cent is allowed on all obligatory dimensions (that is those other than C). Final values of masses can be adjusted by controlling the dimension H.

*The cross-section of the top of the knob is elliptical. For all weights, major axis being twice the minor axis (therefore for all weights B=½A).

**This is a recommended dimension.

TABLE—2

NOMINAL DIMENSIONS FOR SHEET METAL CARAT WEIGHTS

[Clause 4(b)]

| Denomination<br>Carat | Size<br>a<br>mm |
|---|---|
| 2 | 12 |
| 1 | 10 |
| 50/100 | 9 |
| 20/100 | 8 |
| 10/100 | 7 |
| 5/100 | 6 |
| 2/100 | 5 |
| 1/100 | 4 |
| 0.5/100 | 3 |

Tolerance ± 10 per cent

(*c*) *Permissible Errors*

| Denomination carat | Verification: Errors in excess only mg | Inspection: Excess | Inspection: Deficiency mg |
|---|---|---|---|
| 2 | 0.8 | | 0.4 |
| 1 | 0.6 | same as on | 0.3 |
| 50/100 | 0.4 | verification | 0.2 |
| 20/100 | 0.2 | | 0.1 |
| 10/100 | 0.2 | | 0.1 |
| 5/100 | 0.1 | | 0.05 |
| 2/100 | 0.1 | | 0.05 |
| 1/100 | 0.1 | | 0.05 |
| 0.5/100 | 0.1 | | 0.05 |

**5. Manufacture and Finish:**

(a) The surface of the weights shall be reasonably smooth. Sheet metal weights shall be smoothly sheared and shall be free from burrs.

(b) For better stability and finish, the weights may be nickel, or rhodium plated.

6. **Marking :**

(a) Every weight, except weights of 50 carat and lower denominations, sball have the manufacturer's name or trade mark and the denomination indelibly marked on it.

(b) The denomination shall consist of the Indo-Arabic numeral prefixed and suffixed by the letter 'कै' and 'c' respectively, except that in the case of weights below 50 carat, only the numerals shall be marked. The size of numerals and letters indicating the denomination of weights shall be at least twice tbe size of letters indicating the manufacturer's name or trade mark.

(c) The markings sball be legible and deep enough to ensure indelibility over a long period of use, but not so deep as to crack the weight itself.

7. **Packing :**

(a) Each set of carat weights shall, in addition to the series of denominations specified in clause 2, consist of an additional piece of weight or the relevant decimal multiple of two.

(b) The weights shall be supplied in a suitable velvet-lined box. Tbe small sheet metal weights sball be so housed and provided with a cover of glass or any other transparent material that they will not get dislodged from their proper places. The box shall also contain a pair of forceps for lifting the weights.";

(B) for Part VIII, the following Part shall be substituted, namely:—

"PART VIII

FABRIC OR PLASTIC TAPE MEASURES

1. **General :**

(a) This Part deals with fabric or plastic tape measures which are used for measurements where the use of rigid length measures is not convenient or practicable.

(b) Tape measures of 0.5 m to 5 m, made of materials specified in clause 3 (b), are intended to be used for measurements required in the tailoring trade, for anatomical measurements or housebold measurements. Tape measures of 5 m and above, made of materials specified in clause 3 (c) are intended to be used for measurements of buildings, roads, timber and timber products and for other similar measurements but not for measurements of land, storage tanks, fermentation vats and other similar measurements.

2. **Nominal Lengths :**

Fabric or plastic tape measures shall be made in nominal lengths of 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 4 m, 5 m or multiples of 5 metres, provided that the maximum nominal length shall not exceed 100 metres.

*Note*:—The nominal length of a fabric or plastic tape measure is the distance, at the reference temperature of 20°C, between the initial and terminal graduation lines, when the tape measure is stretched, in the wet or dry condition, and without friction, on a horizontal plane surface, under a tension of 20 newtons. The length so measured shall be equal, within the limits of maximum permissible errors, to the nominal length of the tape measure.

3. **Materials :**

(a) The materials used shall be adequately strong, stable and resistant to atmospheric conditions under the normal conditions of use and shall comply with the following requirements :

(i) When ordinarily used at temperatures between ±8°C of the reference temperature, the variation in length of the tape measure shall not exceed the maximum permissible error ;

(ii) When used with a change of ±10 per cent in the tension, the variation in length of the tape measure shall not exceed the maximum permissible error.

(b) *Tape measure of nominal length 0.5 m to 5 m :*

(i) The tape measure may be made from a suitable fabric or plastic material.

(ii) The fabric shall be coated with suitable paints, enamels or other suitable coating so as to give the tape measure a good finish. All coatings shall be non-cracking and water resistant.

(c) *Tape measure of nominal length 5 m and above :*

(i) If made from fabrics, the fabric may be reinforced length-wise with rust-proof and rigid wires of metal or other equivalent material.

(ii) If made from plastic materials, the tape measure may be reinforced length-wise by means of rust-proof and rigid wires of metal or glass fibres.

(iii) If made from any other material, the tape measure shall satisfy the conditions specified in clause 3 (a).

4. **Manufacture;**

(a) *General:*

(i) Tape measures shall be well-made, robust and carefully finished.

(ii) The transversal section of the tape measures shall have such dimensions and shape that, under normal conditions of use, it allows the tape measure to have the accuracy specified for its class.

(iii) Tape measures shall be so made that when they are stretched over a plane surface, their edges are practically straight and parallel.

(iv) The rings, winding devices or other devices shall be attached to the tape in such a manner that they do not cause any inaccuracy or permanent deformation in the tape.

(v) Figure 5 illustrates a measure of fabric or glass fibre and container.

(b) *Tape measures of nominal length 0.5 m to 5 m:*

(i) Tape measures of nominal length 0.5 m to 5 m shall have a width of not less than 5 mm and not more than 25 mm.

(ii) If not wound on a spool or in a case, both the ends of the tape measure shall be reinforced with plastic or metal strips of the same width as the tape measure, over a length of not less than 10 mm or more than 100 mm.

(iii) If wound on a spool or in a case, the tape measure shall have a metal ring or other device securely attached to the outer end of the tape measure. A device for retraction or winding of the tape shall be provided. (See Fig. 2)

(c) *Tape measures of nominal length 5 m and above:*

(i) The tape measures shall have a width of not less than 10 mm and a thickness between 0.3 and 0.6 mm.

(ii) A metal ring shall be securely attached to the outer end of each tape measure. The ring shall be securely fastened to the tape measure by a metal strip of the same width as the tape. (See Fig. 2)

(iii) The outer end of the tape measure shall be reinforced over a length of not less than 100 mm by a strip of leather or other suitable material of the same width as the tape measure. The strip shall pass round the inner end of the ring and under the metal strip. (Fig. 3 shows an inner end of a measure.)

*Note*—This strip, besides serving as a protective device, shall also be utilised for affixing the stamp of verification.

(iv) The tape measure shall be rolled into a suitable container or wound on a winding device, made of metal, plastic, leather or other suitable material. (See Fig. 5)

**Graduations**

(a) *General requirements:*

(i) Graduation lines shall be clear, uniform, indelible and so made as to ensure firm, easy and unambiguous reading.

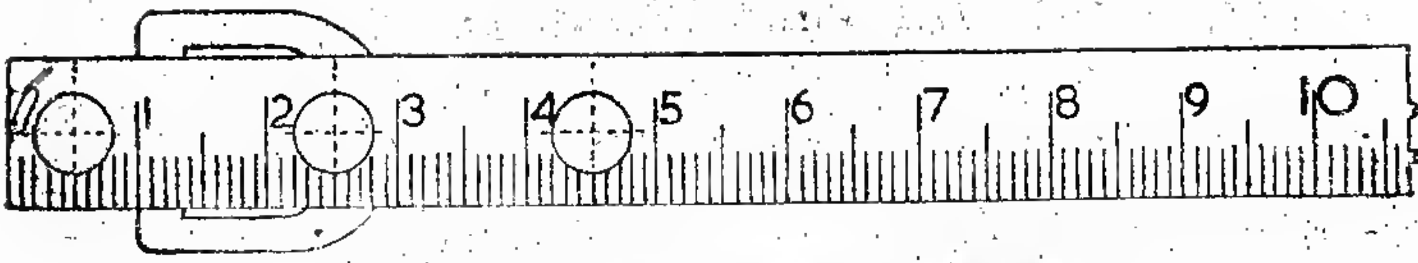



FIG. I ILLUSTRATION OF A MEASURE COMMENCING WITH ZERO

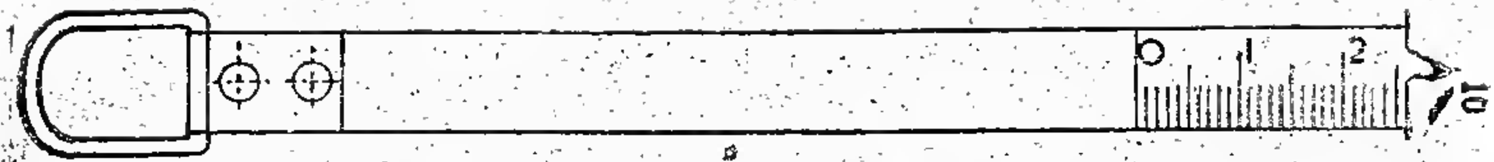



FIG. 2 MEASURE WITH ZERO AWAY FROM RING

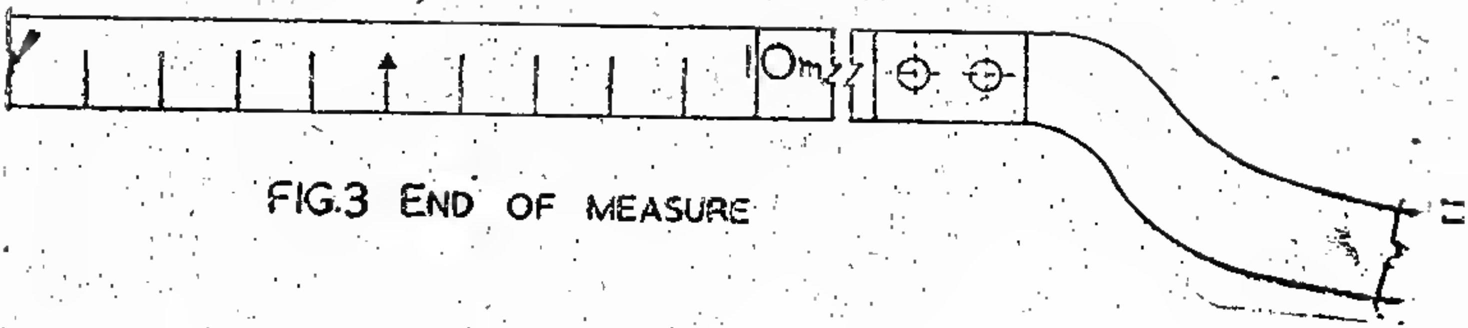



FIG.3 END OF MEASURE

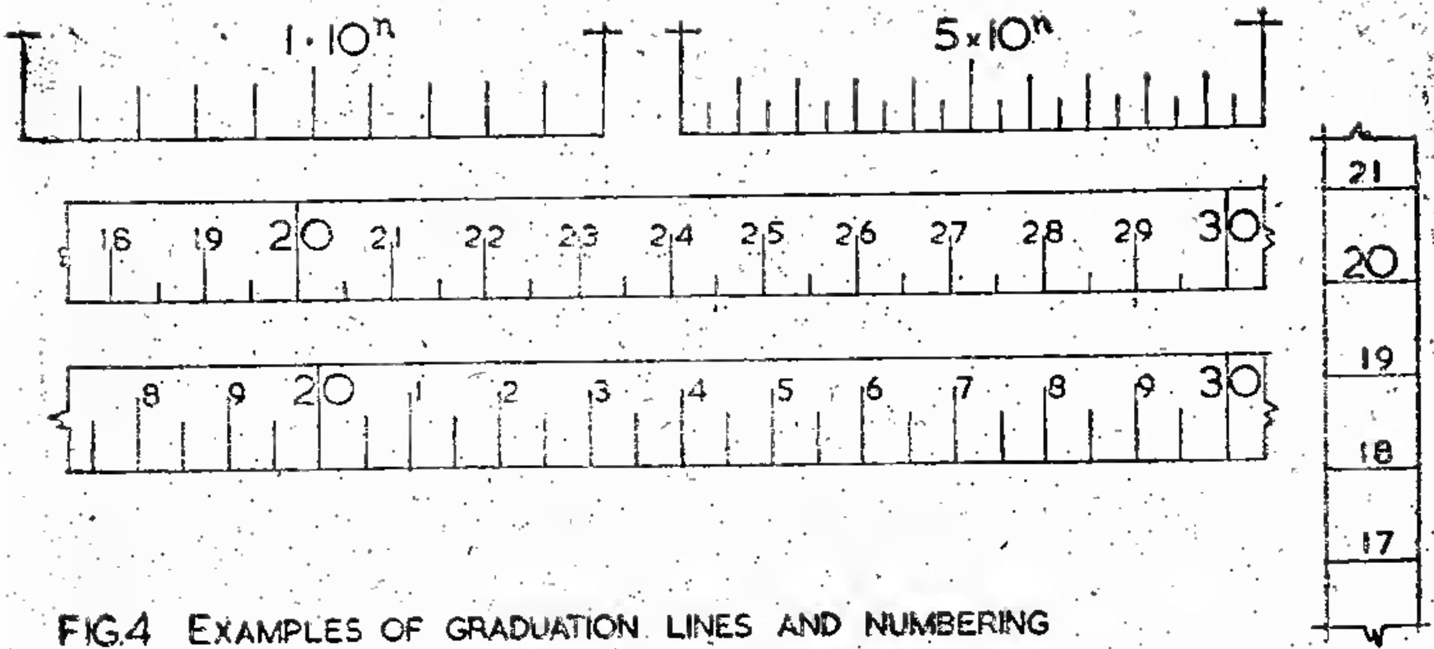



FIG.4 EXAMPLES OF GRADUATION LINES AND NUMBERING

(ii) The value of the graduations shall be of the form $1 \times 10^n$ $2 \times 10^n$, or $5 \times 10^n$, the exponent "n" being an integral positive or negative number or zero. The graduations, however, shall not exceed ;

1 cm, on measures of nominal length less than or equal to 2 m,

10 cm, on measures of nominal length more than 2m, but less than 10m,

20 cm, on measure of nominal length more than 10m, but less than 50m,

50 cm, on measures of nominal length equal to or more than 50m.

(iii) Graduation lines shall be straight, perpendicular to the axis of the tape measures and of uniform thickness throughout their length, their thickness not exceeding 1 mm.

(iv) Graduation lines shall be so made that the scale is neat and clean and their thickness does not cause any inaccuracy of reading.

(v) The tape measure shall be graduated only in decimal multiples and submultiples of the metre, and graduations or other indications showing or relating to units other than metric units shall not be made on any surface of the tape measure.

(vi) Fig. 4 shows examples of graduation lines and numbering.

(b) *Tape measures of nominal length 0.5m to 5 m*

(i) The zero graduation line may be located at the outer end of the ring or other device or may commence on the tape itself at a length equal to or greater than 50 mm from the outer end of the ring or other device. (See Fig. 1 and 2)

(ii) The tape measures may be graduated throughout at every millimetre or every 5 mm.

(iii) The graduation lines at every 10 mm shall be marked in such a manner that there is no confusion between the 10 mm lines and the millimetre or 5 mm lines.

(iv) The tape measures may be graduated on one side or both the sides. If the tape is graduated on one side, the manufacturer's name, trade mark, advertisement or other similar matter may be printed on the ungraduated side of the tape measure.

(c) *Tape measures of nominal length 5 m and above*

(i) The zero graduation line may be located at the outer end of the metal ring or on the tape itself, at a length equal to or greater than 100 mm from the outer end of the ring. (See Fig. 1 and 2)

(ii) The tape measures may be graduated throughout at every millimetre, every 5 millimetres or every 10 millimetres.

(iii) The graduation lines at every 10 mm shall be marked in such a manner that there is no confusion between the 10 mm graduation lines and the millimetre or 5 mm graduation lines.

(iv) The graduation lines at every 10mm shall have a length approximately half the width of the tape.

(v) Every graduation line at 50mm shall have the same length as the graduation line at 10 mm but may have an arrow at its end. This requirement shall not apply to tape measures graduated at every millimetre.

(vi) The zero graduation line, the graduation lines at every 100 mm and at every metre shall have a length equal to the width of the tape.

**6. Numbering:**

(a) *Numbering requirements* :

(i) The numerals shall be indicated clearly, uniformly and indelibly and shall be easily and unambiguously legible.

(ii) The places, dimensions, shape, colour and contrast of the numerals shall be suitable for the scale and graduation lines to which they relate.

(iii) The numerals shall be marked parallel to or perpendicular to the axis of the tape measure depending upon the intended manner of use of the measure.

(iv) Fig. 4 shows examples of graduation lines and numbering.

(b) *Tape measures of nominal length 0.5 m to 5 m*:

(i) Every graduation line at 10 mm shall be marked with the completed number of centimetres. When indicating the number of centimetres exceeding 100, centimetres may be given.

*Explanation.*—The graduation number marked may be, for example 122 and not 22, after completion of one metre.

(ii) The height of the numerals shall not exceed two-thirds the width of the tape measures.

(c) *Tape measures of nominal length 5 m and above*:

(i) The graduation lines at every 100 mm and at every metre shall be numbered. The numerals shall have a height of not more than two-thirds of the width of the tape.

(ii) The metre graduations shall be accompanied by the symbol 'm' and, if required, "मी".

(iii) After the graduation line at one metre, every graduation line at 100 mm may be marked with an additional numeral indicating the completed number of metres. This numeral, if provided, may be located just above, below or in line with the numeral of the 100 mm graduation line. The height of this numeral may be approximately half the height of the numerals indicating 100 mm.

7. **Maximum Permissible Errors :**

(i) On initial verification, under the conditions specified in clause 2, the maximum permissible error on the length between any two graduation lines shall not exceed:

Class I $= \pm (0.1+0.1L)$ mm

Class II $= \pm (0.3+0.2L)$ mm

Class III $= \pm (0.6+0.4L)$ mm

where L is the length between the two graduation lines concerned, expressed in metres, rounded off to the next higher whole number of metres.

(ii) The error on the length interval between the axes of any two consecutive graduation lines and the difference between any two consecutive length intervals shall not exceed the following limits:—

| | Length of interval | Maximum permissible error in mm | | |
|---|---|---|---|---|
| | | Class I | Class II | Class III |
| (1) | less than or equal to 1 mm | 0.1 | 0.2 | 0.3 |
| (2) | greater than 1 mm but less than or equal to 10 mm | 0.2 | 0.4 | 0.6 |
| (3) | greater than 10 mm but less than or equal to 100 mm | 0.3 | 0.5 | 0.9 |

(iii) The maximum permissible error on tape measures in use shall be twice that specified for initial verification, the method of verification remaining unchanged.

(iv) Tape measures of nominal length 0.5 m to 5 m shall belong to accuracy Class II or, Class III.

(v) Tape measures of nominal length 5 m and above shall belong to accuracy Class I, Class II or Class III.

8. **Markings:**

(a) *Tape measures of nominal length 0.5 m to 5 m:*

The tape measure and the case or container, (See Fig. 5) if provided, shall be marked at a suitable place with the manufacturer's name or trade mark or both, and the nominal length of the tape measure.

(b) *Tape measures of nominal length 5 m and above:*

The tape measure and the container, (See Fig. 5)case or other device, where provided, shall be marked, near the zero graduation line and on the container, case or other device with the following markings:

(i) nominal length in metres,

(ii) manufacturer's name or trade mark or both,

(iii) class of accuracy : I, II or III in an oval.

(c) The inscriptions shall be clearly visible and legible.

(d) Publicity inscriptions, if made, shall be carried out in such a manner that they do not intrude in any way with the use of the tape measure.

9. **Sealing** :

The stamp of verification shall be affixed on the metal, plastic, leather or other strip provided at the beginning of the tape measures.

(C) for Part X, the following Part shall be substituted, namely:—

"PART X

## STEEL TAPE MEASURES

**1. General :**

This Part deals with steel tape measures which are used for measurements where the use of rigid length measures is not convenient or practicable.

**2. Classes of Steel Measures :**

Steel tape measures shall be divided into three classes, namely, Class I, Class II and Class III, in accordance with their accuracy.

**3. Nominal Lengths :**

Steel tape measures shall be made in nominal lengths of 0.5m, 1m, 1.5m, 2m, 3m, 4m, 5m or multiplies of 5m, provided that the maximum nominal length shall not exceed 200m.

*Note:*—The nominal length of a steel tape measure is the distance, at the reference temperature of 20° C, between the initial and terminal graduation lines, when the tape measure is stretched, without friction, on a horizontal plane surface, under a tension of 50 newtons. The length so measured shall be equal, within the limits of maximum permissible errors, to the nominal length of the tape measure.

**4. Materials :**

(a) The materials used shall be adequately strong, stable and resistant to environmental influences under normal conditions of use and shall comply with the following requirements:

(i) When ordinarily used at temperatures between $\pm$ 8° C of the reference temperature, variation in length of the temperature shall not exceed the maximum permissible error;

(ii) when used with a change of $\pm$ 10 per cent in the tension, the variation in length of the tape measure shall not exceed the maximum permissible error.

(b) The tape measure shall be made from steel or stainless steel.

*Note:*—It is recommended for guidance of manufacturers and users that the coefficient of thermal expansion utilised may preferably be $(11.5\pm1)\times10^{-6}$ per °C for Class I tape measures, and $(11.5\pm2)\times10^{-6}$ per °C for Class II and Class III tape measures.

**Manufacture:**

(a) Tape measures shall be well-made, robust and carefully finished.

(b) The transversal section of the tape measure shall have such dimensions and shape that, under normal conditions of use, it allows the tape measure to have the accuracy specified for its class.

*Note*:—It is recommended for guidance of manufacturers and users that tape measures may have a width of not less than 5 mm and a maximum thickness of 0.4 mm.

(c) The steel tape measure shall be so made that when it is stretched on a plane surface, the edges are practically straight and parallel.

(d) At the zero end, tape measures shall be provided, with a ring or other device for facilitating withdrawal. The ring or other device, when provided, shall be fastened to the tape measure by a metal strip of the same width as the tape. (See Fig. 2)

(e) Tape measures shall be capable of being wound into suitable container or other winding device of robust construction and made of metal, plastic, leather or other suitable material.

(f) The winding devices shall be so designed that they do not cause any inaccuracy or permanent deformation in the tape.

(g) The edges of tape measures shall be slightly rounded.

(h) The tape measure shall be provided with a rust-proof coating and shall be free from burrs.

(i) Fig-3 illustrates the inner end of a measure.

**6. Graduations :**

(*a*) *General requirements* :

(i) Graduation lines shall be clear, uniform, indelible and so made as to ensure firm, easy and unambiguous reading.

(ii) The value of the graduations shall be of the form $1\times10^n$; $2\times10^n$ or $5\times10^n$ metres, the exponent "n" being a positive or negative whole number or zero.

The graduations, however, shall not exceed :

1 cm, on measures of nominal length less than or equal to 2m,

10 cm, on measures of nominal length more than 2 m, but less than 10m,

20 cm, on measures of nominal length more than 10 m, but less than 50 m,

50 cm, on measures of nominal length equal to or more than 50 m.

(iii) Graduation lines shall be straight, perpendicular to the axis of the tape measure, and of uniform thickness throughout their length

(iv) Graduation lines shall be so made that the scale is neat and clear and their thickness does not cause any inaccuracy of reading.

(v) The tape measure shall be graduated only in decimal multiples and sub-multiples of the metre, and graduations or other indications showing or relating to units other than metric units shall not be made on any surface of the tape measure.

(vi) Fig. 4 shows examples of graduation lines and numbering.

(b) Tape measures of 5 m to 200 m shall be graduated only on one side. Tape measures of 0.5m to 5m may be graduated on both sides, with different scales.

(c) The graduated lines, numbers and other markings shall be either in relief, engraved, typographically printed or made in any other suitable manner.

(d) The zero graduation line may be located at the outer end of the ring or other device, or may commence on the tape measure itself, at a length equal to or greater than :

(i) 50 mm from the outer end of the ring or other device, in the case of tape measures of nominal length 0.5 m to 5 m and

(ii) 100 mm from the outer end of the ring or other device, in the case of tape measures of nominal length 5m and above. (See Fig. 1 and 2).

(e) Tape measures of denominations 0.5 m to 5 m may be graduated throughout at every millimetre, every 5 millimetres or every 10 millimetres.

(i) The graduation lines at every 10 mm shall be marked in such a manner that there is no confusion between the 100 mm graduation lines and the millimetre or 5 mm graduation lines.

(ii) In the case of tape measures graduated at every 5 mm or 10mm, not less than the first 100 mm shall be subdivided into millimetres.

(f) In the case of tape measures of nominal legnth of .5 mm and above, every graduation line at 50mm shall have the same length as the graduation line at 10 mm but may have an arrow at its end. This requirement shall not apply to tape measures graduated at every millimetre.

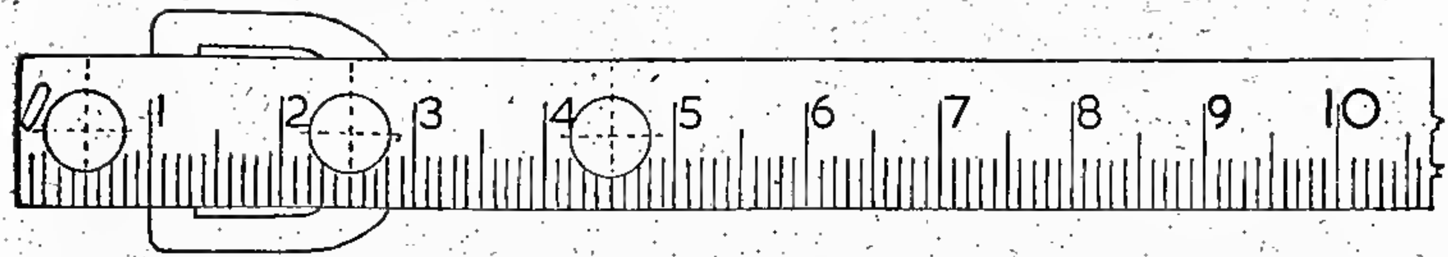



FIG. I ILLUSTRATION OF A MEASURE COMMENCING WITH ZERO

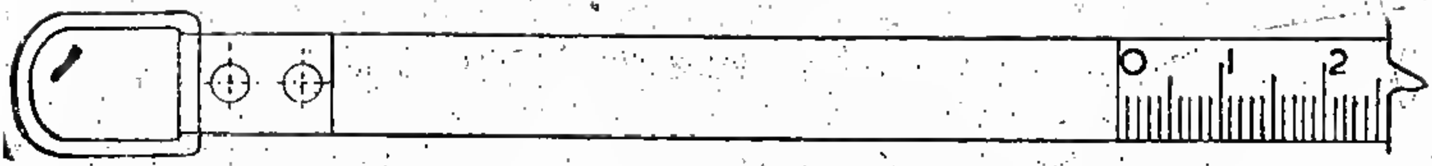



FIG. 2 MEASURE WITH ZERO AWAY FROM RING

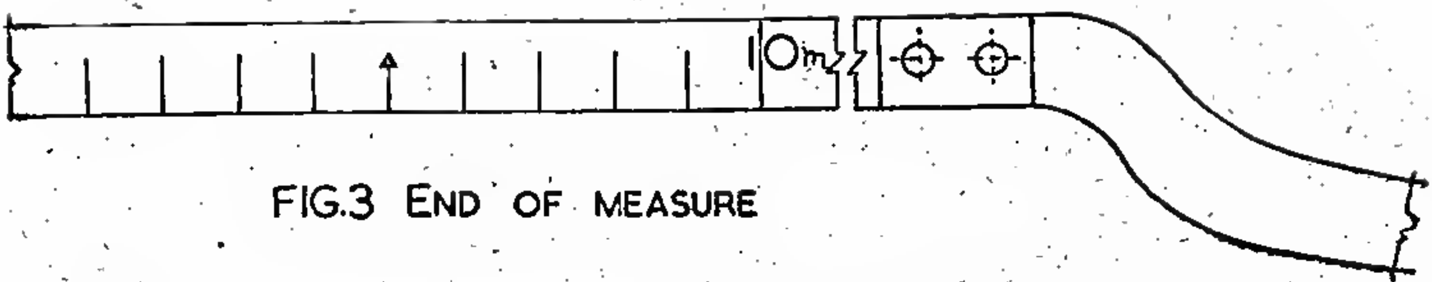



FIG.3 END OF MEASURE

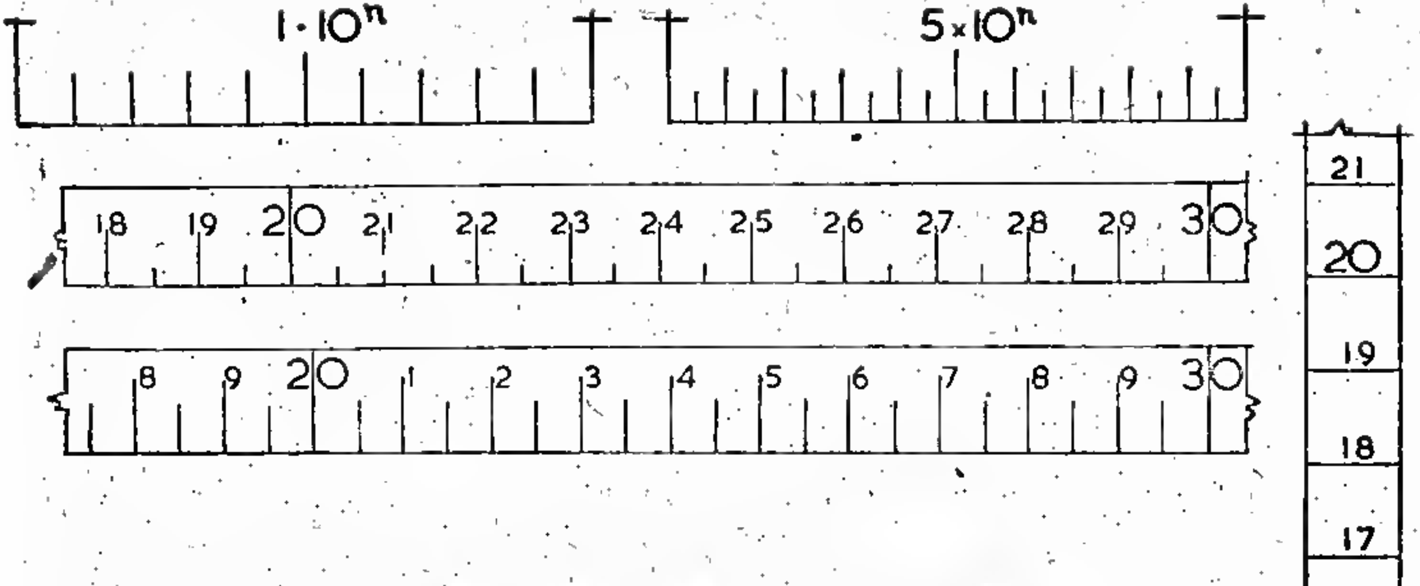



FIG.4 EXAMPLES OF GRADUATION LINES AND NUMBERING

(g) The thickness of the graduation lines shall not exceed the following limits :
0.4mm in the case of Class I and Class II tape measures, and
0.5 mm in the case of Class III tape measures.

(h) In the case of tape measures of nominal length 0.5 m to 5m, the graduation lines may have a length between one-fourth and full width of the tape, depending upon convenience. In the case of tape measures of nominal length 5m and above, the length of the graduation lines may be as follows :

(i) for millimetre graduation lines, about one-third of the width of the tape,

(ii) for 5 millimetre graduation lines, about half the width of the tape,

(iii) for 10 millimetre graduation lines, about two-thirds the width of the tape, ana

(iv) for 100 millimetre graduation lines and for metre graduation lines as well as for the zero graduation lines, equal to the width of the tape.

**Numbering** :

(*a*) *Numbering requirements* :

(i) The numerals shall be indicated clearly, uniformly and indelibly and shall be easily and unambiguously legible.

(ii) The place, dimension, shape, colour and contrast of the numerals shall be suitable for the scale and the graduation lines to which they relate.

(iii) The numerals shall be marked parallel to or prependicular to the axis of the tape measure depending upon the intended manner of use of the measure.

(iv) Fig. 4 shows examples of graduation lines and numbering.

(b) The following graduation lines shall be numbered.
10 mm, for tape measures of nominal length 0.5 to 5 m.
100 mm, for tape measures of nominal length exceeding 5m.

(c) The metre graduation lines shall be numbered and accompanied by the symbol 'm', and, if required "मी".

(d) In the case of the tape measures of nominal length 0.5 m to 5m, the height of the numerals shall be such as would facilitate the reading of the measurement without ambiguity.

(e) In the case of tape measures of nominal length 5 m and above, after the graduation line at one metre, every graduation line at 100 mm may be marked with an additional numeral, indicating the completed number of metres. This numeral, if provided, may be located just above, below or in line with the numeral of the 100 mm graduation line. The height of this numeral may be approximately half the height of the numerals indicating 100 mm.

(f) In the case of tape measures of nominal length 5 m and above, the height of the numerals, except those given in sub clause (e) above, may be :

(i) about 1/3 of the width of the tape, for 10 mm graduation lines,

(ii) about 1/2 of the width of the tape, for 100 mm graduation lines, and

(iii) about 2/3 of the width of the tape, for metre graduation lines.

(g) If tapes of 0.5 m to 5 m are contained in special containers, the container may be marked with its dimension, for example, 50mm, to facilitate measurement of internal dimensions.

**8. Maximum Permissible Errors :**

(a) On initial verification, under the conditions specified in clause 2, the maximum permissible error on the length between any two graduation lines shall not exceed :

Class I = ± (0.1 + 0.1 L) mm,
Class II = ± (0.3 + 0.2 L) mm, and
Class III = ± (0.6 + 0.4 L) mm,

where L is the length between the two graduation lines concerned, expressed in metres, rounded off to the next higher whole number of metres.

(b) The error on the length interval between the axes of any two consecutive graduation lines and the difference between the two consecutive length intervals shall not exceed the following limits :

| Length of interval | Maximum permissible error in mm | | |
|---|---|---|---|
| | Class I | Class II | Class III |
| (1) less than or equal to 1 mm | 0.1 | 0.2 | 0.3 |
| (2) greater than 1 mm but less than or equal to 10 mm | 0.2 | 0.4 | 0.6 |
| (3) greater than 10 mm but less than or equal to 100 mm | 0.3 | 0.5 | 0.9 |

(c) The maximum permissible error on tape measures in use shall be twice that specified for initial verification, the method of verification remaining unchanged.

(d) Steel tape measures of nominal length 0.5 m to 5 m shall belong to accuracy Class I or Class II.

(e) Tape measures of nominal length 5 m to 200 m shall belong to accuracy Class I, Class II or Class III.

**9. Marking :**

(a) The steel tape measures shall be marked at a suitable place near the end and on the container, where provided, with the following markings :

(i) nominal length in metres,

(ii) the manufacturer's name or trade mark or both,

(iii) class of accuracy : I, II or III in an oval.

(b) The inscriptions shall be clearly visible and legible.

(c) Publicity inscriptions, if made, shall be carried out in such a manner that they do not intrude in any way with the use of the tape measure.

**10. Sealing :**

The stamp of verification shall be affixed on the metal, or other device affixed at the beginning of the tape measure."

(D) after Part XIII, the following Parts shall be inserted, namely:—

"PART XIV

## TAPES FOR USE IN MEASUREMENT OF OIL QUANTITIES

**1. General:**

This Part covers the requirements of tape with the dip weight attached to its end to be used in gauging petroleum, petroleum products and other oils.

**2. Definitions:**

A dip tape shall mean essentially a graduated steel tape in one continuous length used in conjunction with a dip weight.

**3. Denominations:**

The tape shall be of the denominations 5, 10, 15, 20, 25 and 50 metres.

**4. Material:**

(a) *Tape*—The steel used shall have a minimum tensile strength of 150 $kgf/mm^2$.

(b) *Dip Weights or Dip Bobs*—The dip weights shall be made of brass or other non-sparking or low sparking material, sufficiently hard to resist damage by contact with steel.

**5 Dip tape:**

(a) The dip tape shall be of the following dimensions:

*Width* : 13 mm or 16 mm

*Thickness* : Between 0.20 and 0.30 mm

*Length* : One continuous piece of sufficient length for the purpose required. The tape shall be longer than the distance between the dip reference point and the bottom of the container.

(b) *Graduations.*—The tape shall be marked legibly and indelibly on one side only with a line at every millimetre or five millimetres, centimetre, decimetre and metre. The height of marking lines shall be as follows:

| *Unit of graduation* | *Approximate height of graduation* mm |
|---|---|
| Millimetre | 4 |
| Five millimetres | 6 |
| Centimetre | 8 |
| Decimetre | Full width of the tape |
| Metre | Full width of the tape |

(c) The tape shall be so made that it is capable of being wound on a drum and held in a winding frame or case.

(d) The free end of the tape shall be fitted with the dip weight or arrangements provided for attaching the dip weight.

6. **Dip weights:**

(a) Dip weights shall be of two types, light and heavy, and shall be of cylindrical torpedo shape. The dimensions for light and heavy dip weights shall be as shown in Fig. 1.

(b) The light type may either be fixed permanently to the tape or attached separately to it by any suitable device.

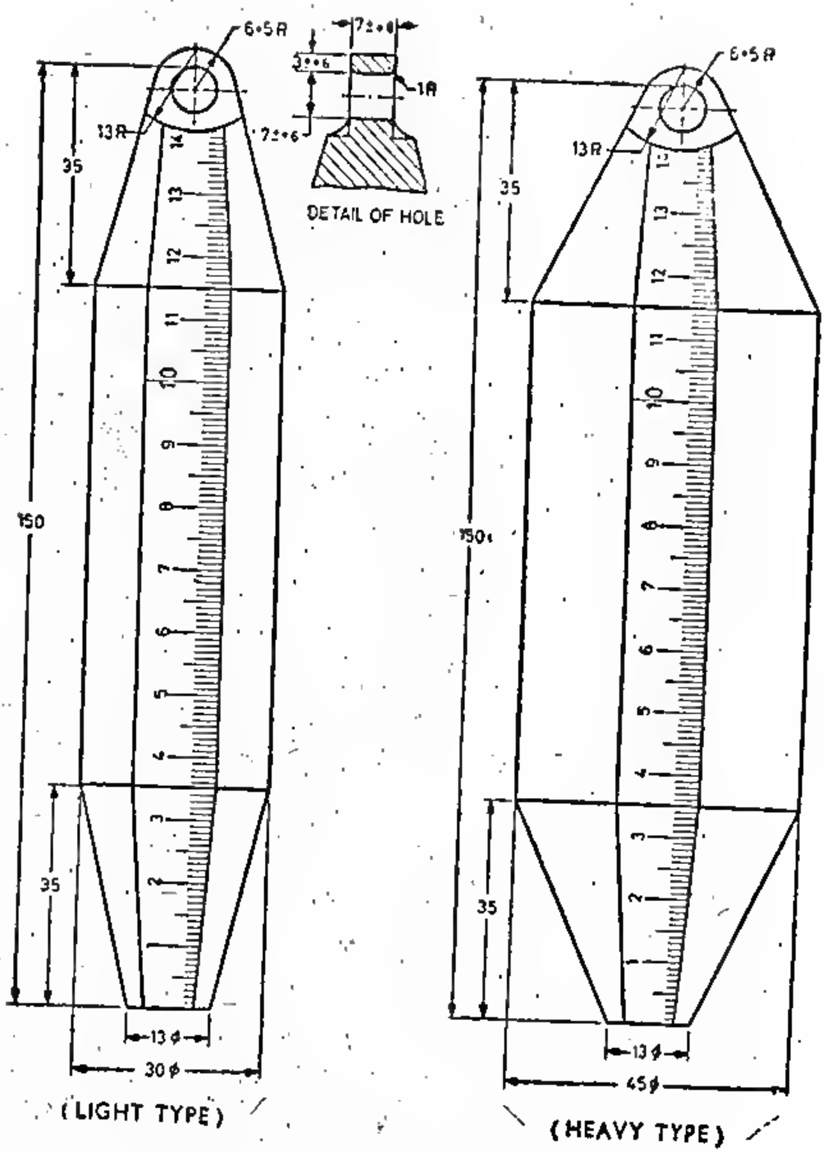
(c) The heavy type shall be attached to the tape by a swivel hook (see Fig. 2).

(d) The dip weight shall have the lengths of graduation and weigbts given below:

| | *Light* | *Heavy* |
|---|---|---|
| Length of graduations from bottom | 150 mm | 150 mm |
| Weight | 700 ± 50 g | 1500 ± 50 g |

(e) The dip weight shall be graduated in a manner similar to the tape.

(f) The graduations on the dip weight shall begin from its bottom and shall be carried over in such a manner that when the dip weight is attached to the tape the graduations are continuous from the weight to the tape.




All dimensions in millimetres.

Fig. 1. Light and Heavy Dip Weights

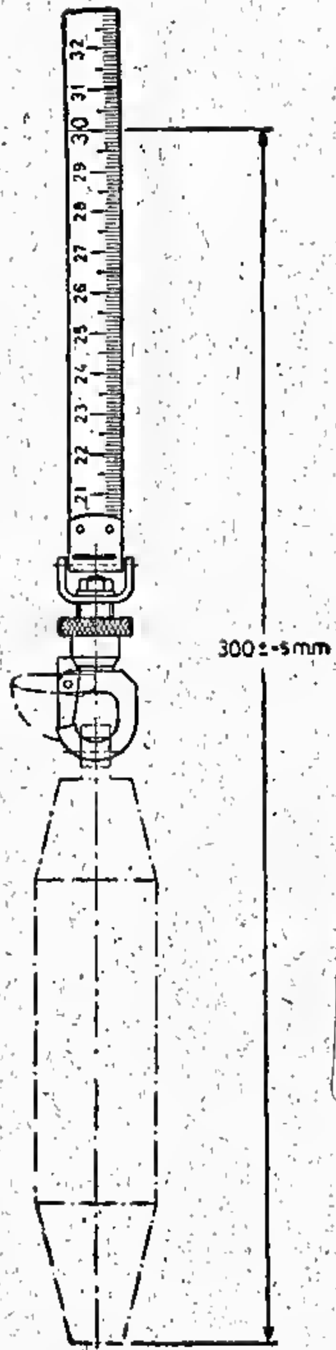





FIG. 2 SWIVEL HOOK ATTACHM

**7. Permissible errors:**

When checked against the working standard calibrated at a temperature of 20°C, the error in the length of the tape supported on horizontal surface with a tension of 50 newtons shall not exceed the following limits:

| | |
|---|---|
| (a) Between any two adjoining mm and cm lines | Not more than ± 0.2 mm |
| (b) Between any two adjoining decimetre and metre lines | Not more than ± 0.4 mm |
| (c) From Zero to the points specified below: | |
| (i) One metre mark | ± 0.4 mm |
| (ii) Two metre mark | ± 0.6 mm |
| (iii) Five-metre mark | ± 1.0 mm |
| (iv) Any metre mark beyond the first five metres | ± 1.0 mm for the first five metres plus 0.5 mm for each additional five metres or part thereof subject to a maximum error of 2.0 mm |

**8. Markings:**

(a) Every centimetre, decimetre and metre shall be marked with Indo-Arabic numerals. The decimetre and metre numerals shall be in bold type. The metre divisions shall, in addition bear the designation 'मी' or 'm' or both. The end of the tap' measure shall be marked with word 'मीटर' or 'Metre' or both.

(b) On the ungraduated side and on the case of each tape and also on the dip weight, the name or trade-mark of the manufacturer and the denominations shall be legibly marked. In addition, direction of winding shall also be legibly marked on the case or reel. Suitable provisions shall be made for Inspector's stamps on the dip weight and the tape.

(c) Every dip weight and dip tape shall be suitably marked to identify them with each other.

## PART XV

## LARGE CAPACITY CALIBRATING MEASURES (NON-TILTING TYPE)

1. **General :**

This Part covers the requirements of large capacity calibrating measures of the stationary and portable types intended for use in checking commercial bulk measures, vehicle tanks, bulk meters etc.

2. **Definitions:**

(a) **Capacity of Delivering Measure.**—The quantity of liquid that will be delivered by the delivering measure, when the measure is filled up to the nominal graduation mark, so that the bottom of the meniscus coincides with the top edge of the nominal graduation mark, and is emptied as described in 7 (a) of this Part.

(b) **Capacity of Measure used as Container.**—The quantity of liquid that the measure will contain when it has been filled as described in 7 (b) of this Part so that the bottom of the meniscus coincides with the top edge of the nominal graduation mark.

3. **Denominations :**

The calibrating measures shall be of the following denominations: 50, 100, 200, 500, 1000, 1500, 2000 and 5000 litres.

4. **Forms, Dimensions and Tolerances :**

(a) Calibrating measures shall be vertical cylinders fitted between conical ends and generally of the form shown in Fig. 1. The dimensions shall be as given in the Table. The maximum neck heights shall be 400 mm for all calibrating measures. The full capacity mark of the measure shall be marked by the manufacturer on the neck so as to conform to clause 6 (c) of this Part.

(b) The permissible error in the capacity of the measure shall be ± 0.1 per cent of the capacity of the measure, on verification as well as inspection.

5. **Material :**

The body of the measure shall be made of mild steel plate. The neck shall be made of mild steel pipe or plate. The thickness of the plate, of which the measure is made, shall be as follows.

| Capacity | Minimum thickness |
|---|---|
| Upto and including 500 litres | 1.8 mm |
| 1000 and 1500 litres | 2.5 mm |
| 2000 and 5000 litres | 4.0 mm |

TABLE

## DIMENSIONS OF LARGE CAPACITY CALIBRATING MEASURES

[Clause 4 (a) and Fig. I]

All dimensions in millimetres.

| Capacity litres | D | H | d | h | h1 | h2 | F | $d_2$ (nominal) |
|---|---|---|---|---|---|---|---|---|
| 50 | 440 | 273 | 100 | 400 | 62 | 62 | 40 | 100 |
| 100 | 540 | 368 | 125 | 400 | 76 | 80 | 50 | 100 |
| 200 | 680 | 464 | 200 | 400 | 88 | 105 | 60 | 100 |
| 500 | 920 | 637 | 300 | 400 | 113 | 149 | 75 | 100 |
| 1000 | 1160 | 801 | 400 | 400 | 138 | 193 | 90 | 100 |
| 1500 | 1330 | 915 | 500 | 400 | 151 | 222 | 98 | 100 |
| 2000 | 1480 | 979 | 600 | 400 | 160 | 250 | 105 | 100 |
| 5000 | 2020 | 1311 | 1000 | 400 | 186 | 350 | 125 | 100 |

Note:—Tolerance on dimensions $\pm$ 5 percent.

6. **Construction :**

(a) The measures shall be of fully welded construction, all welds being external and continuous with good penetration and free from scale. All interior joints shall be smooth and free from projections.

(b) Measures shall be free from surface defects and indentations. External surfaces shall be painted and the internal surfaces lined with a good quality resistant coating such as epoxy resin.

(c) The top neck shall be provided with a gauge glass or a glass window or an overflow pipe to ascertain the correct capacity of the measure. The gauge glass or glass window shall have a suitable graduated scale marked on it. The scale shall cover $\pm$0.1 per cent of the capacity of the measure from the point of the full capacity mark of the measure.

(d) Measures shall be provided with a filling pipe having its lower end close to the bottom of the measures,

(e) A baffle plate shall be fitted above the outlet of the measure to minimize turbulence and prevent liquid swirl and vortex formation. Baffles shall be so designed that they do not trap air or liquid during filling and emptying operations nor impede the flow of liquid.

(f) The outlet valve shall be so constructed that the measure is completely emptied.

(g) A measure permanently installed shall be supported by a structure secured to the ground. A typical installation of a calibrating measure for calibrating meters in shown in Fig. 2, and an arrangement for calibrating bulk vehicle tanks is shown in Fig. 3.

(h) The portable measure supported by legs shall be provided with sufficient screw jacks permanently attached to the base of the cradle to enable it to be levelled in two planes. The measure shall be provided with two spirit levels at right angles to each other.

(i) One or two adjusting devices shall be provided on the measure. A typical device is shown in Fig. 2. The device shall be capable of positive adjustment and shall be self-locating. It shall have a total range of adjustment equivalent to a quantity ± 0.5 percent of the capacity of the measure.

(j) Suitable sealing arrangements shall be provided to seal the adjusting device and the scales, if these are adjustable. Lugs shall be provided on the measure to facilitate sealing.

(k) A manhole or hand hole shall be provided on the body of the measure as shown in Fig. 2 to enable entry into the measure for purposes of internal painting and to carry out internal inspection, if required.

7. **Calibration Procedure :**

(a) *Calibrating Measure calibrated for delivery .—*

(i) The calibrating measure shall be clean, free from rust and grease and shall be tested for leaks with water.

(ii) The measure shall be filled with water up to the full capacity mark on the guage glass or until it overflows into the overflow pipe. The contents shall then be withdrawn by opening the outlet valve and collected in a precalibrated measure of suitable size. When the entire contents of the tank have been collected and measured, it is possible to know, to what extent the capacity is more or less than the correct capacity. The necessary adjustment is then made with the adjusting device and the procedure repeated until the capacity is correct within the permissible errors. If an adjustable scale has been provided, it may be used for final adjustment. The adjustment device and the movable scale shall then be sealed.

(b) *Calibrating Measure calibrated for content .—*

(i) The calibrating measure shall be clean, free from rust and grease, and shall be tested for leaks with water.

(ii) Measured quantities from a test measure are poured until the level of the water reaches the full capacity mark on the sight glass. The difference between the volume of water filled and the correct capacity is calculated and the necessary adjustment made with the adjusting device. The procedure is repeated until the calibrating measure fills correctly to the full capacity mark or just begins to overflow. If an adjustable scale has been provided, it may be used for finer adjustments. The adjusting device and the adjustable scale shall then be sealed.

## 8. Markings :

Each measure shall have the capacity and manufacturer's name or trade-mark clearly and indelibly marked on it. The denominations shall be marked in Indo-Arabic numerals.

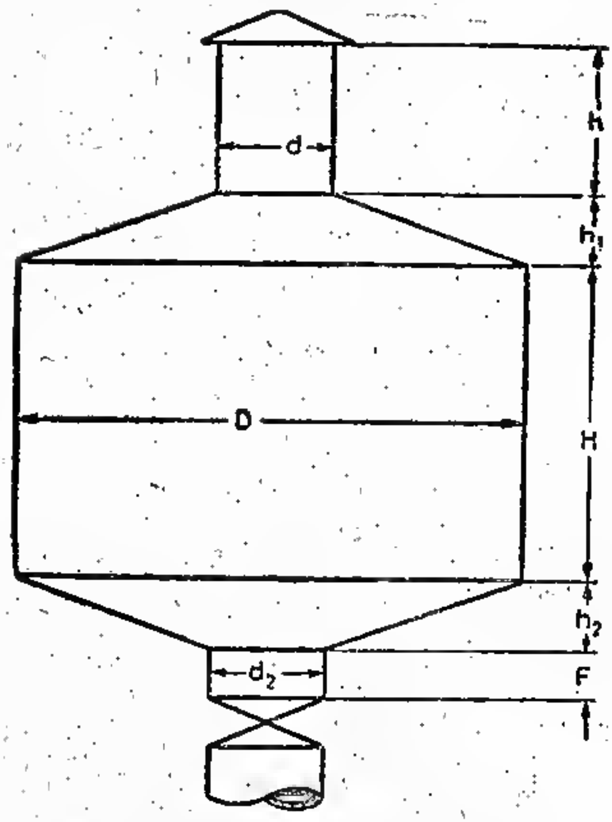



Fig. 1. FORM OF CABIRATING MEASURE

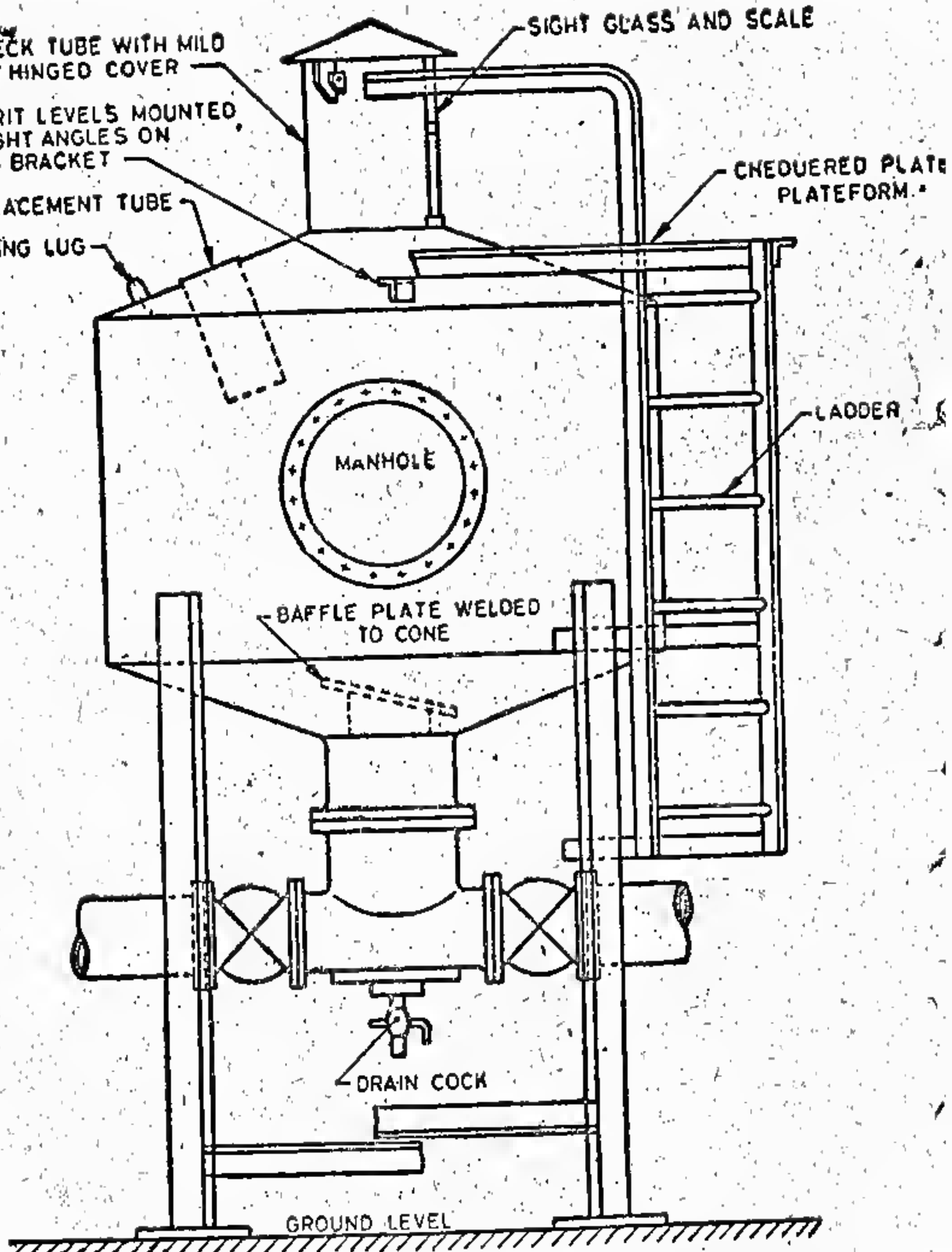



Fig. 2. INSTALLATION FOR CALIBRATING BULK METER.

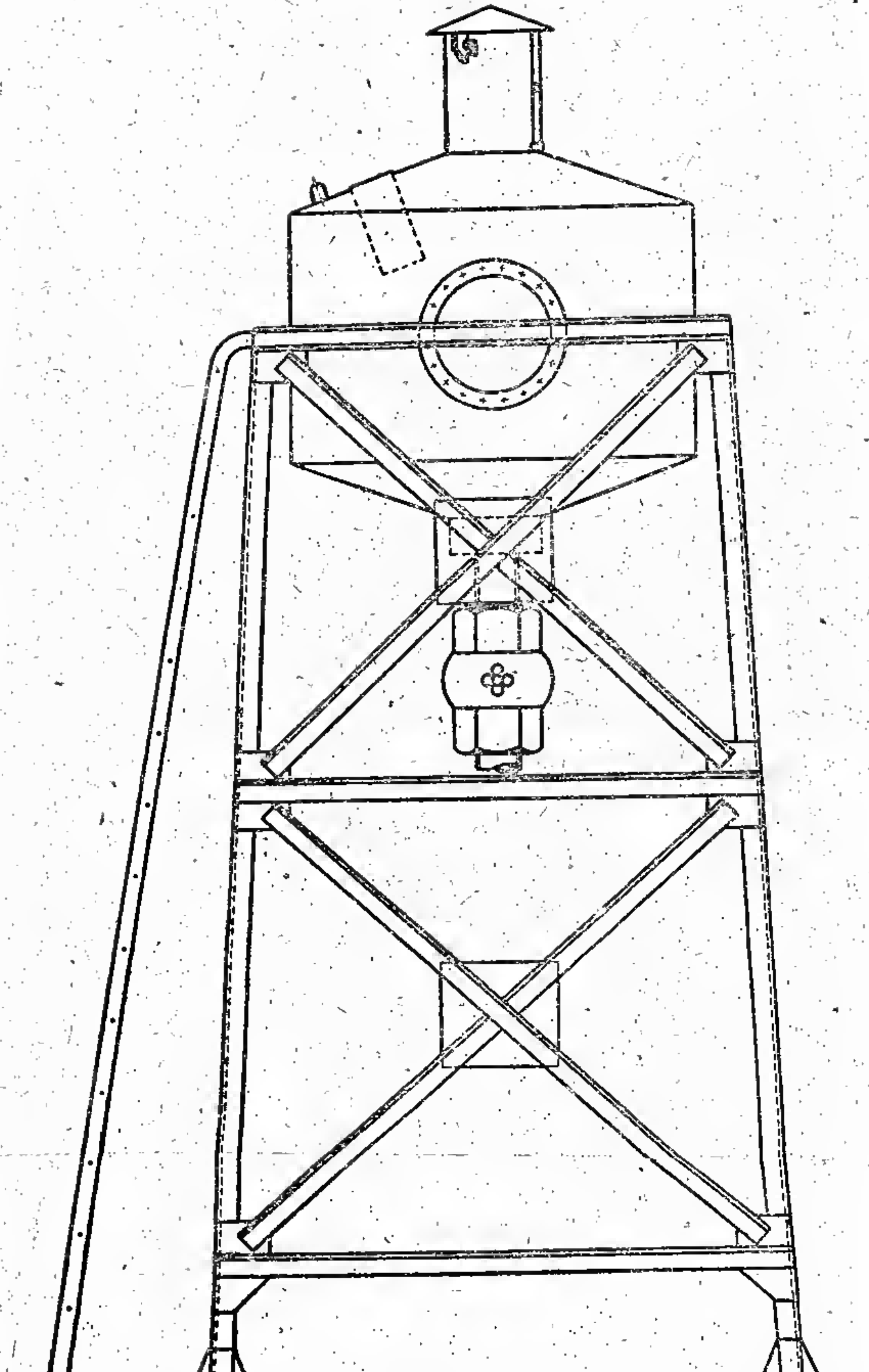



Fig. 3. ARRANGEMENT FOR CALIBRATING VEHICLE TANKS

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## PART XVI

# METHOD FOR CALIBRATION OF VERTICAL OIL STORAGE TANKS

**1. Scope:**

This Part prescribes methods for calibration of vertical tanks by strapping and internal measurements. These tanks are meant for bulk storage of petroleum and liquid petroleum products.

**2. Conditions For Measurements:**

(a) All data and methods, whereby measurements are obtained, necessary for the preparation of calibration tables, shall be in accordance with sound engineering principles.

(b) When drawings for the tank are available, all measurements shall be compared with those obtainable from the drawings and measurements showing discrepancies greater than the tolerance specified in clause 9 (c), shall be verified. A similar process of check shall be employed in all cases where reliable information beyond the measurements taken, is available.

(c) Measurements shall be taken only after the tank has been filled at least once at its present location with the product to be store to its working capacity or with water to its equivalent height, and such product or water has been held in the tank for at least 24 hours to allow for settling.

**3. Interrupted Measurements:**

If the calibration of a tank is required to be interrupted, it may be resumed with minimum delay, without repetition of work previously completed provided that:

(i) there is no major change in equipment and as far as possible, no change in personnel;

(ii) all records of work done are complete and legible ; and

(iii) same hydrostatic head as before is maintained in the tank.

**4. Descriptive Data:**

(a) Complete descriptive data shall be entered on the Tank Measurements Record Form being used. A recommended record form is shown in the Table.

(b) Supplemental pencil sketches or notations each completed, identified, dated and signed, shall form an important part of field data. These shall be made to indicate typical horizontal and vertical joints, number of plates per course (ring), locations of courses (rings) at which thickness of plates changes, arrangement

and size of angles of top and bottom of shell, location and sizes of pipes and manholes, dents and bulges in shell plates, direction of lean from vertical, method used in by-passing a large obstruction, such as clean-out box or insulation box located in the path of a circumferential measurement, location of tape path, location and elevation of possible datum plate and all other items of interest and value which will be encountered.

TABLE

## RECOMMENDED RECORD FORM FOR MEASUREMENTS OF VERTICAL TANKS

[Clause 4 (a)]

Report No..........

Date................

Tank No.....................

(Old Tank No.)...............

Owner's Name................

Plant or Property Name..........

Location......................

Manufactured by...............

Erected by....................

Description...................

Prepare..........Copies..........Increments in..................

Fraction to..........Table Form or Size Desired..................

Height: Shell..............Gauging..............................

Type of Roof: ..........Weight of Floating Roof..................

Tank Contents........Name..........Avg. Liquid Temp., °C..........

Gauge..................cm or mm Innage to Shelf Floor or Outage:

Hydrometer Reading........at........°C..........Sample Temperature

Gauging Reference Point to Top of Top Angle......................cm or mm............Normal

Service...............................................................

Shell Circumferences or Diameters:

A..............D..............G..............

B..............E..............H..............

C..............F..............J..............

Descriptions of shell Plates and Joints:*

| Course (Ring) No. | Thickness | Type of Vertical joint | Set, in or out | Width of lap of strap | Thickness of strap | No. of joints | Exposed course (ring) height | Inside course (ring) height |
|---|---|---|---|---|---|---|---|---|
| 5 | .... | .... | .... | .... | ...... | ...... | ...... | ...... |
| 4 | .... | .... | .... | .... | ...... | ...... | ...... | ...... |
| 3 | .... | .... | .... | .... | ...... | ...... | ...... | ...... |
| 2 | .... | .... | .... | .... | ...... | ...... | ...... | ...... |
| 1 | .... | .... | .... | .... | ...... | ...... | ...... | ...... |

Bottom Course (Ring) Shell Connections:†

| No. | Description | Elevation, Top of Floor to Bottom of Connection |
|---|---|---|
| 1 | .................. | .................. |
| 2 | .................. | .................. |
| 3 | .................. | .................. |
| 4 | .................. | .................. |

Type of Bottom.........Height of Crown....................

Deadwood and Remarks (Use reverse side if necessary):

| Description | No. | Size | Elevation From | Elevation To |
|---|---|---|---|---|
| ........... | ........... | .......... | .......... | ......... |
| ........... | ........... | .......... | .......... | ......... |
| ........... | ........... | .......... | .......... | ......... |
| ........... | ........... | .......... | .......... | ......... |
| ........... | ........... | .......... | .......... | ......... |

Thickness..........Measurements by..........................

Amount of Tank Lean from Vertical ‡

Circumference Tape Used...........Date Checked.........at........

Tank Measured by..........................For...............

Deadwood and Tank Bottom—Use separate sheets. For each piece or item of deadwood record description, size, number of occurrences and location related to other height measured data recorded.

Explanatory Notes (such as type of bottom, height or depth of crown etc).

...................................................................

* Show sketches of vertical horizontal joints at the back of this table.

† Show circumferential location on plan view sketched on back of this table.

‡ Show direction of lean on plan view sketched on back of this table

(c) All measurements made by the tank calibrator shall be recorded on site and shall not be subjected to subsequent correction.

5. **Degree of accuracy :**

In order to obtain maximum obtainable accuracy in calibration tables, adjustments for effects of the following variables shall be incorporated in the tables:

(i) Expansion and contraction of steel tank shell due to liquid heats,

(ii) Tilt from upright position, and

(iii) Tank bottoms that are irregular in shape.

*Note.*—The degree of accuracy desired or required in the completed calibration table for a specific tank shall be the governing factor in determining the procedure to be followed.

6. **Expansion And contraction of steel tank shells due to liquid head and temperature**

These effects shall be eliminated by strapping the tank when it is at least two-thirds full with water or approximately full with the product [see also (c)]. The strapping record shall include water or product level from a known reference point, temperature of the tank contents and that of adjacent air.

SECTION I—CALIBRATION BY STRAPPING

7. **General :**

(a) This method is based on the measurement of external circumferences which are subsequently corrected to yield the true internal circumferences.

(b) Circumferences shall be measured under conditions of liquid head as given under clauses 2 (c) and 6.

(c) The stipulated number of external circumference measurements, together with the subsidiary measurements, where necessary, to correct for deviation of the tape from the true circular path shall be obtained as described under clause 9.

(d) An internal diameter may be measured at approximately the same height as that at which a circumference has been measured, if verification of that circumferential measurement is desired.

(e) It may be necessary in practice to refer all tank dips to a datum point other than the datum point used for the purpose of tank calibration. If so, the difference in level between these datum points shall be determined either by normal surveying methods or by other suitable means.

(f) The overall height shall be measured, using dip-tape and dip-weight, from the dipping datum point to the reference point

(the dipping reference point) on the dip hatch. This overall height shall be recorded and marked on the tank at the dip hatch.

8. **Equipment :**

(a) *Steel Tapes*—shall comply with the specifications under Part X of Schedule IV to these Rules. The tape shall be greased well before use.

(b) *Spring Balance*—reading up to 10 kg. with 0.1 kg. graduations, for measuring the tension applied to the tape. It is preferable to have two balances. Spring balance shall comply with specifications given under Part VI of Schedule V to these Rules.

(c) *Step-Overs*.—The step-over is a frame holding two scribing points rigidly and at such a distance apart as meets the conditions of use laid down under 9(d). The frame may be constructed of wood; it should be painted if required.

This is used to correct deviation of the tape from its normal circular path, namely passing over fittings or joints between plates.

(d) *Dip-Tape and Dip-weight*—complying with the Specifications given under Part XIV of Schedule IV to these Rules.

(e) *Loops and Cords*—One or more metal loops which can slide freely on the tape and to which are attached two cords each of sufficent length to reach from the top of the tanks to the ground. The tape is positioned and its tension evenly distributed by passing these loops around the tank.

(f) *Accessory Equipment* :

- (i) Rope
- (ii) Hooks
- (iii) Safety Belts
- (iv) Ladders

(g) *Miscellaneous Equipment* :

- (i) Steel Rule
- (ii) Spirit Level
- (iii) Awl and Scriber
- (iv) Marking Crayon
- (v) Record Paper
- (vi) Plumb Line
- (vii) Dumpy Level
- (viii) Positive Displacement Bulk Meter

9. **Circumference Measurements :**

(a) **Strapping Levels**—Circumference shall be measured by a minimum of two strappings per course (ring) at the following levels :

a *For riveted tanks*

(i) At 7 percent to 10 percent of the height of exposed portion of each course (ring) above the level of the top of the bottom

angle iron of the tank and above the upper edge of each horizontal overlap between courses (rings) (see A of Fig 1), and

(ii) At 7 per cent to 10 per cent of exposed portion of each course (ring) below the lower edge of each horizontal overlap between courses (rings) and below the level of the lowest part of the top angle iron of the tank (see B of Fig. 1).

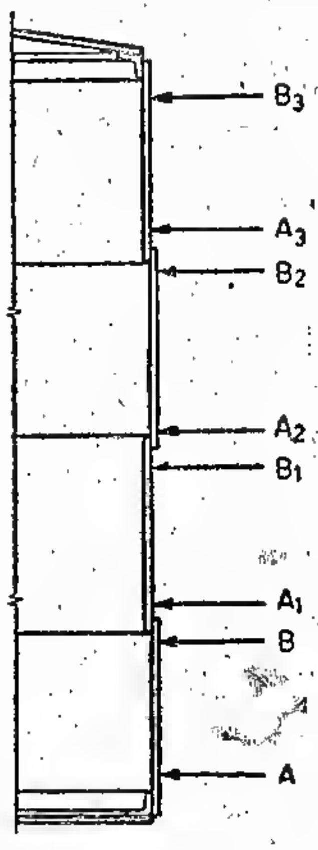



Fig. 1 Locations of Measurements of Rivetd Tanks

b. *For welded tanks*

(i) Two levels (see A and B of Fig. 2), the upper and the lower levels, at the top and bottom of courses (rings) shall be 20 per cent of the height of the exposed portion of the respective course (ring) away from the angle irons or seams.

(ii) Circumferential tape paths, having been located at elevations as under subclause (a) above shall be examined for obstructions and type of vertical joints. Projections of dirt and scale shall be removed along each path.

(iii) Occasionally, some feature of construction such as a manhole or insulation box, may make it impracticable to use a circumference evaluation at the prescribed location. If the obstruction can be spanned by a step-over then the circumference shall be measured at the prescribed elevation, using a suitable method given under clause 9 (d). If the obstruction cannot be conveniently spanned by a step-over,

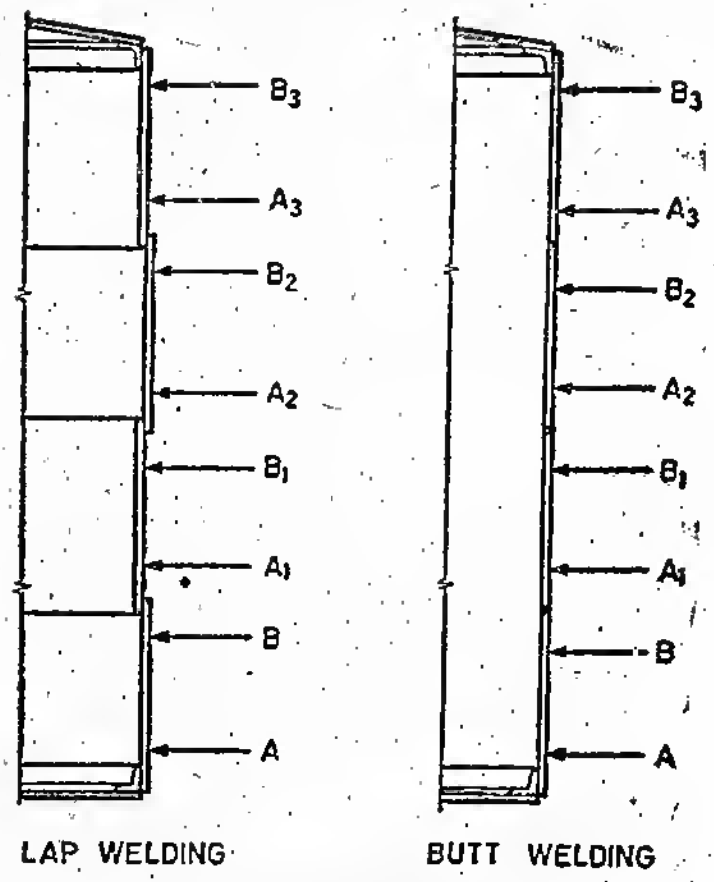



FIG. 2 LOCATIONS OF MEASUREMENTS OF WELDED TANKS

then a substitute path located nearer to the centre of the course (ring) may be chosen. The strapping record shall include the location of the substitute path and the reason for the departure.

(iv) The type and characteristics of vertical joints shall be determined by close examination in order to establish the method of measurement and equipment required. If the tape is not in close contact with the surface of the tank throughout its whole path owing to the vertical joints a step-over shall be applied so that a correction may be calculated to adjust the gross difference for this effect.

(b) **Strapping Procedure:**

(i) The tank shall be strapped by either of the methods described under (ii) and (iii) below. In either case a tension of 4.5 ± 0.5 kg. shall be applied to the tape and, if necessary, transmitted throughout its length by suitable means, namely, by means of metal loops sliding freely on the tape, the loops being passed around the tank by operators with the aid of light chain or cords. The tape path shall be parallel with the circumferential seams of the tank.

(ii) If the tape to be used is not long enough to encircle the tank completely, then after the level of the tape path has been chosen, fine lines shall be scribed perpendicular to this path to allow the circumference to be measured in sections. The scribed lines, shall be drawn, in the middle circumferential third of any plate at such distances as will ensure that the whole of the length of the tape used is under the observation of one or other of the calibrators. Subject to the conditions under clauses 9 (a) (iii) and 9 (a) (iv), the external circumference of the tank is then the sum of the lengths between the scribed lines.

(iii) If the tape to be used can encircle the tank completely, then, after the level of the tape path has been chosen, the tape is passed around the circumference and held so that the first graduated centimetre lies within the middle circumferential third of any plate. The other end of the tape shall be brought alongside. The tension is then applied through the spring balance and transmitted throughout the length of the tape.

(iv) After a circumference has been measured (see (iii) above), the tape shall be shifted a little around the tank, brought to level and tension as above, and the reading repeated. The final reading shall be the arithmetic average of the readings.

(c) **Tolerances.**—Measurements shall be read to the nearest 1 mm and within the following tolerances when readings are taken at the same point:

| Circumference | Tolerance |
|---|---|
| Up to 30 metres | ± 2 mm |
| Over 30 and up to 50 metres | ± 4 mm |
| ,, 50 ,, ,, 70 metres | ± 6 mm |
| ,, 70 ,, ,, 90 metres | ± 8 mm |
| ,, 90 metres | ± 10 mm |

(d) **Step—Overs**:

(i) If the tape crosses obstructions, such as projections, deformities, fittings or lapped joints, it will deviate from a true circular path and an erroneous circumferential measurement will result.

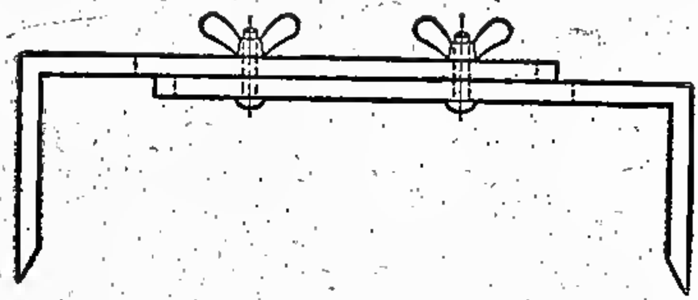


Fig. 3 Step—Over

In order to avoid such errors a 'step-over' is used to measure the correction to be applied for such obstructions.

(ii) *Construction.*—A step-over is a frame rigidly holding two scribing points, and of such dimensions that the points may be applied to the tape well clear of the obstruction and of its effects on the tape path, while the frame itself does not touch either the obstruction or the tank shell. Rigidity of construction is essential; suitable designs are illustrated in Fig. 3.

(iii) *Use of Step-Overs:*

(a) For obstructions, the strapping tape shall be stretched as if in measurement of a circumference on the tank which is being calibrated, but not within 30 cm of any horizontal seam. The scribing points shall then be applied to the tape near the middle of a plate where the tape is fully in contact with the tank surface. The length between the points, as measured on the curved tape, is then read off as closely as possible, fractions of tape divisions being estimated. The readings shall be repeated on a minimum of two and maximum of four plates equally spaced around the circumference, and the average of the results taken, as the step-over will vary with the tank diameter and the course concerned since they are made on surface differently curved.

(b) With the tape still in position and under the tension used in strapping, the step-over shall be applied to the tape on either side of each obstruction lying on the tape path, and readings shall be taken of the lengths of tapes included between the scribing points. All step-over readings shall be recorded for subsequent use in calculation.

(c) Care shall be taken in placing the instrument in a truly level position at each obstruction to avoid distortions in circumferential path. In the case of a step-over of relatively long space, the use of a spirit level is recommended as an aid in determining its correct position before scribed marks are struck off on the places.

(d) When the butt-strap or lap joints, or tank shell, include rivets or other features which exert uneven effects on the resultant void between tape and tank from joint to joint, then a step-over will be required. The span of the instrument should be measured prior to use in accordance with (a) above. The two legs shall be separated by a distance sufficient to span each void between tape and shell encountered. The legs shall be of sufficient length to prevent contact between the interconnecting member and the tank plate or obstruction. Stretch the tape over the joints and place the step-over in position at each location of void between tape and shell, completely spanning the void so that the scribing points, contact the shell at an edge of the tape. The length of tape encompassed by the scribing points, with the tape maintained in proper position and tension, should be estimated to the nearest 0.5 mm. At each step-over location, therefore, the difference between the length of tape encompassed by the scribing points and the known span of the instruments is the effect of the void, at that

point, on the circumference as measured. The sum of such differences in any given path, subtracted from the measured circumference, will give the corrected circumference.

**10. Shell Plate Thickness :**

(a) Where the type of construction leaves the plate edges exposed, a minimum of four thickness measurements shall be made on each course (ring) at points approximately equally spaced about the circumference. The arithmetical average of the measurements for each course (ring) shall be recorded; all thickness measurements, properly identified, shall be noted on a supplemental data sheet which shall form a part of the measurements record. Care shall be taken to avoid plate thickness measurements at locations where edges have been distorted by caulking.

(b) Where plate edges are concealed by the type of construction, the strapping record shall be marked 'not obtainable at tank'. Alternately, plate thickness measurement may be obtained as described under (c) below.

(c) Plate thickness measurements obtained before or during construction, and recorded on a properly identified strapping record may be acceptable. In the absence of any direct measurements of plate thickness obtained and recorded before or during construction either those shown on the fabricator's drawings may be accepted and so identified in the calculation records or any other practicable method may be used for measurements of plate thickness.

**11. Vertical Measurements :**

(a) A tape shall be suspended internally along the wall of the shell from the top curb angle to the bottom course (ring) and the height of the course (ring) measured to the nearest millimetre. The difference in height between the datum plate at which dip is taken and the bottom course (ring) shall be measured and the headings of the course (ring) height shall be transferred to the datum plate by applying the correction (see Fig. 4).

*Example*: In Fig. 4, the difference between bottom course (ring) and datum plate is 152-150.5 cm=1.5 cm. Applying this correction the corrected height of the course (ring) at

B=307.5 cm

C=468.5 cm

D=623.5 cm

E=798.5 cm

(b) When it is inconvenient to measure the course (ring) heights internally, then they shall be computed from external measurements, due allowance being made for the effect of horizontal seam

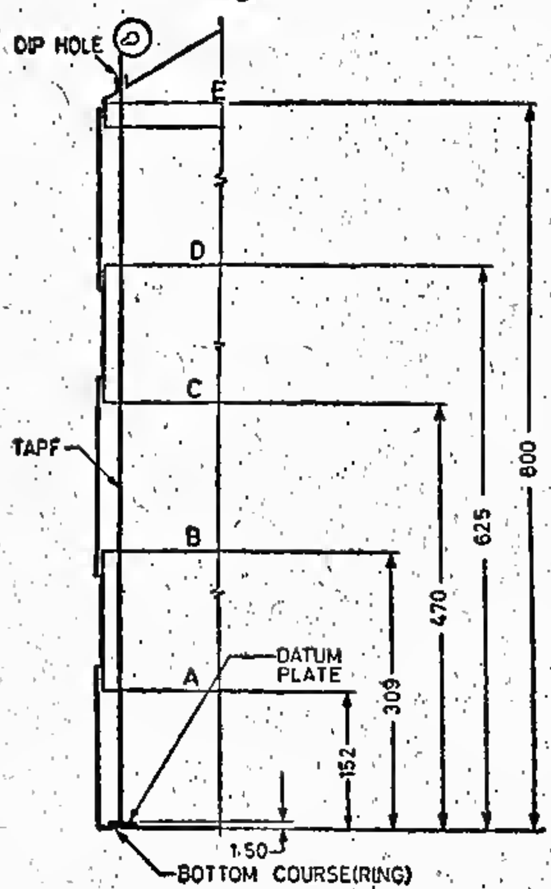



Fig. 14.

overlaps. The heights obtained shall be the vertical distances, measured to the nearest 5 mm, between successive edges of the courses (rings) as exposed internally in the tank. For this purpose, in the cases of lap joints, it will be necessary to determine the width of lap in each course (ring).

(c) If necessary, heights at more than one vertical around the tank may be taken, and for each course (ring), an average of the results obtained.

12. **Deadwood :**

(a) Any fitting which adds to or subtracts from the capacity of the tank is called deadwood. Deadwood shall be accurately accounted for, as to size and location to the nearest millimetre in order to permit:

(i) adequate allowance for volumes of liquid displaced or admitted by the various parts, and

(ii) adequate allocation of the effects at various elevations within the tank.

(b) Deadwood should be measured, if possible, within the tank. Dimensions shown on the builder's drawings may be accepted if actual measurement is impracticable.

(c) Measurements of deadwood should show the lowest and highest levels, measured from the tank bottom adjacent to the shell, at which deadwood affects the capacity of the tank. Measurements should be in increments which permit allowance for its varying effect on tank capacity at various elevations.

(d) Large deadwood of irregular shape may have to be measured in separate sections suitably chosen.

(e) Work sheets on which details of deadwood are sketched dimensioned and located, should be clearly identified and should become part of the strapping record.

(f) For variable deadwood, such as nozzles and manholes, encountered in the bottom one or two courses (rings) of the tanks, an average deadwood correction shall be made.

**13. Tank Bottoms :**

(a) *Flat Type*

(i) Tank bottom which are flat and stable under varying liquid loads will have no effect on tank capacity depressed on the basis of geometric principles.

(ii) Where tank bottom conditions of irregularity, slope and instability exist, and where correct capacities cannot be determined conveniently from linear measurements alone, it shall be necessary to resort either to liquid calibration or to floor survey.

(iii) *Liquid Calibration.*—The procedure in carrying out the liquid calibration is to fill into the tank quantities of known volume of water or other non-volatile liquid until the datum point is just covered and the total quantity recorded. Additional quantities shall then be added until the highest point of the bottom is just covered. This may be done in one or more stages as desired and the dip reading and quantity at each stage recorded. It is convenient for dip readings to be taken at intervals of approximately 3 cm, the successive intervals not necessarily being identical.

This liquid may conveniently be measured into the tank by a positive displacement meter which should be previously calibrated for the liquid and rate of flow to be used. Alternatively, an accurately calibrated measure or tank may be used.

(iv) Volumes for the tank calibration table above this elevation shall be computed from linear measurements.

(v) *Floor Survey.*—The floor survey consists in recording levels of the floor by means of a dumpy level with the help of the spirit levels, the cross sections and the longitudinal sections of the entire floor may be computed. The levels when plotted will define the profile and the geometric pattern of the bottom of the tank. Thus the capacity of the tank may be calculated.

(vi) During the tank bottom calibration the difference in height between the datum plate and the bottom of the bottom course (ring) should be recorded, wherever possible.

(b) *Conical, Hemispherical, Semi-ellipsoidal and Spherical Segment.*

Tank bottoms conforming to geometrical shapes have volumes which may either be computed from liner measurements or measurements by liquid calibration by incremental filling or by floor survey, as desired. Any appreciable differences in shape affecting the volume, such as knuckle, radii, etc, shall be measured and recorded in sufficient detail to permit computation of the true volume.

14. **Measurement of Tilt:**

Measurements shall be taken to determine the amount, if any, by which the tank is tilted. This can conveniently be done by suspending a plumb line from the top angle and measuring the offset at the bottom angle (see Fig. 5). Alternatively, if the tank bottom is being calibrated by floor survey with a

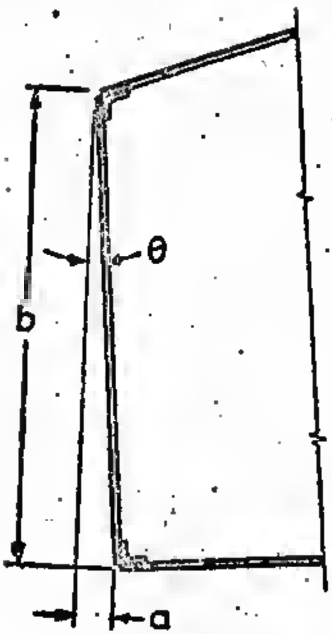



Fig. 5.

dumpy level as in clause 13(a) (v), the tilt can be estimated by taking reading along the periphery of the tank bottom. Also, if a liquid calibration of the bottoms is being made as outlined in clause 13 (a) (iii), the tilt can be determined by taking measurements from the surface of the liquid to the bottom of the tank. In any of these methods, a sufficient number of measurements shall be taken at different points on the circumference to determine the maximum offset.

15. **Floating-Roof Tanks:**

(a) All calibration measurements shall be made exactly as for tanks with fixed roofs.

(b) *Liquid Calibration for Floating—Roof Displacement*:

(i) Corrections for floating-roof displacement arising from the weight of the roof and the deadwood associated with it shall be allowed for in the calibration measurement.

(ii) If the weight of the floating-roof is accurately known correction for the displaced liquid may be applied knowing density and temperature of the tank contents, at the time of determining the actual inventory.

(c) Alternately, displacement due to the floating-roof and deadwood may be determined by admitting oil to the tank until the dip reading is just below the lowest point of the roof. Known quantities accurately determined (for example by flow meter or delivery from a portable tank or measure which has been accurately calibrated) are then admitted to the tank and the corresponding dip readings recorded at a number of suitable intervals until the point is reached when the roof just becomes oil borne. Record the density and temperature of oil used.

(i) It is advisable to use a liquid of nearly the same density as that for which the tank is intended. If this is not practical, water may be used and suitable corrections applied.

(ii) During liquid calibration any space under the roof that will trap gas should be vented to the atmosphere.

(iii) Before liquid calibration the height of the lowest joint of the roof with reference to datum point should be recorded, wherever possible.

(iv) To assess the point at which roof becomes oil borne the following procedure may be followed:

With the roof resulting fully on its supports, paint four short horizontal white lines about 3 cm wide on the tank sides in such a position that, viewed from some definite point, their lower edges are just above four similar lines marked on the roof edges or shoes. Then slowly pump oil into the tank; when all roof markings are seen to have moved upwards, regard the roof as oil borne, and take the dip reading of the

out at this level. Alternatively, from some chosen view point on the dipping platform, note the position of the roof against rivet heads on vertical seam or other markings on the tank walls instead of paint marks. In both cases extend the points of reference round the greater part of the tank interior, and see movement relative to all points.

(d) *Weight Floating*—The floating weight of the entire roof shall include weight of roof plus half the weight of the rolling ladder and other hinged and flexibility supported accessories that are carried up and down in the tank with the roof. These are calculated by the tank fabricator and given on the drawing and on the roof name-plate.

(e) *Deadwood:*

(i) Fixed deadwood shall be measured as described in clause 12. The drain lines and other accessories attached to the underside of the roof shall be treated as fixed deadwood in the position they occupy when the roof is at rest on its supports.

(ii) When all or part of the weight of the roof is resting on its supports, the roof itself is deadwood and as the liquid level rises around the roof, its geometric shape will determine how it should be deducted. The geometric shape should be taken from the fabricator's drawings or measured in the field with the aid of an engineer's level while the roof is resting on its supports.

16. **Variable Volume Roofs:**

(a) Roofs such as lifter, flexible membrane, breather or balloon, may require special deadwood measurements for roof parts that are sometimes submerged. When these parts, such as columns, are fixed relative to the tank shell, they should be measured as deadwood in the usual way. When these parts move with the roof and hang down into the liquid, they should be deducted as fixed deadwood with the roof in the lowest position. Details may be secured from the fabricator or measured in the field.

(b) Some variable volume roofs have flexible members which may float on the surface when the membrane is deflated and the liquid level is high. The floating weight of the membrane displaces a small volume of liquid. Data on the floating weight should be secured from the fabricator and supplemented, if necessary, by field observation and measurement.

(c) Some variable volume roofs have liquid seal troughs or other appurtenances which make the upper outside part of the shell inaccessible for outside circumference measurements. Liquid calibration of this portion of the shell may be made, or (i) theoretical dimensions may be taken from the fabricator's drawings, or (ii) the highest measurable circumferential measurement may be used as a basis for the portion of the tank that cannot be measured. When the method (i) or (ii) is used, it shall be so indicated on the calibration table.

## SECTION II—CALIBRATION BY INTERNAL MEASUREMENT

**17. General:**

(a) This method is based on the measurement of internal diameters.

(b) Diameters shall be measured only after the tank has been filled atleast once at its present locations with the product to its working capacity or with water to its equivalent height, and such product or water has been held in the tank for at least 24 hours to allow for settling.

(c) The stipulated number of internal diameters shall be obtained as described under clause 19 (a) (iv).

(d) Where practicable, an external circumference shall be measured at approximately the same height as that at which a set of diameters of which a verification is desired, has been taken. The resulting internal diameters shall be compared, and if a discrepancy is found, the measurements shall be verified.

(e) It may be necessary in practice to refer all tank dips to a datum point other than the datum point used for the purpose of tank calibration. If so, the difference in levels between these datum points shall be determined either by normal surveying methods or by other suitable means.

(f) The overall height shall be measured using dip-tape and dip-weight, from the dipping datum point mentioned in (e) above to the reference point (the dipping reference point) on the dip hatch. This overall height shall be recorded and marked on the tank at the dip hatch.

**18. Equipment:**

(a) *Steel Tape*—Complying with the specification given under Part XIV of Schedule IV to these Rules. The tape shall be greased well before use.

(b) *Dynamometer*—This is used for applying tension to the steel tape.

(c) Other equipment as referred to under 8.

**19. Diameter Measurements:**

(a) **Procedure:**

(i) All diameter measurements shall be made with a tension of 4.5 + 0.5 kg applied to the tape as indicated by the dynamometer.

(ii) All tape measurements shall be recorded as read, that is without including the length of the dynamometer.

(iii) The dynamometer length at 4.5 kg shall be taken accurately before it is put into commission, and subsequently checked before and after calibration of each tank, the final check being made before leaving the site.

(iv) The measurements shall be taken between diametrically opposite points at the following levels on each course (ring), the minimum number allowable at each level being two on each course (ring), at right angles to each other :

(a) *For riveted tanks* (see Fig. 1) :

(1) at 10 per cent of the height of exposed portion of each course (ring) about the level of the top of the bottom angle iron of the tank and above the upper edge of each horizontal overlap between courses (rings), and

(2) at 10 per cent of the height of exposed portion of each course (ring) below the level of the lower edge of each horizontal over-lap between courses (rings)and below the level of the lowest part of the top angle iron of the tank :

(b) *For welded tanks* (see Fig. 2)—Two levels, the upper and the lower levels, at the top and the bottom of courses (rings), shall be 20 per cent of the height of the exposed portion of the respective course (ring) away from the angle irons or seams ;

(c) *All tanks*—No measurements shall be taken nearer than 30 cm to any vertical seam ;

(v) If for any reason it is impracticable to take measurements at the positions described above, then the diameters shall be taken as close to the proper position as practicable, but not nearer the horizontal seams than is specified under (b) above.

(vi) The levels at which measurements have been taken shall be recorded together with reasons for abandoning the prescribed level.

(vii) Measurements shall be taken with the zero end of the steel tape attached to the dynamometer, one operator placing the dynamometer on the predetermined point and the second operator placing the rule end-on to a point diametrically opposite. The tape with the graduated side wholly upwards is then pulled along the rule until the requisite tension is registered by the sounding of the buzzer in the dynamometer. The relative position of tape and rule is maintained by a firm grip until the rule is removed from the side of the tank and the measurement read on the tape at the end of the rule which was previously in contact with the tank side. The operation shall be repeated at the various positions at which measurements are required throughout the tank. The measurements shall be recorded clearly in white chalk on the steel plates in such a manner as to indicate the positions at which they were taken.

(viii) Each measurement of diameter shall be recorded to the nearest .

(b) **All other measurements shall be followed in accordance with Section I.**

## PART XVII

## METHOD FOR COMPUTATION OF CAPACITY TABLES FOR VERTICAL OIL STORAGE TANKS

1. **Scope :**

This method prescribes the methods of computation on capacity tables for vertical storage tanks intended for bulk storage of petroleum and liquid petroleum products.

2. **General :**

(a) The calculation shall be made in accordance with accepted mathematical principles.

(b) At the head of each capacity table it shall be clearly stated that the dip/capacity relationship applies only to dips taken at one specified point. This point shall be clearly marked on the tank, and the height of the dipping reference point shall be recorded at the head of the capacity table.

3. **Form of Tank Tables :**

Provided that tank tables have been prepared in accordance with the principles laid down in this standard, the form in which the tables is set out will not alter the accuracy of the figures obtained from it, but the following principles shall be applied in preparing the tank tables :

(i) The intervals of dip at which the tables are set out shall not be so great that interpolation for intermediate dips is difficult. It is convenient to set out tables at intervals of dip not greater than 5 cm, for then a small proportional parts table, calculated on the average content of the tank per unit depth, may be used for calculating the litres corresponding to inter-decimal dips. In the case of lap joints, however, the proportional parts table should be set out for every course (ring). Levels affected by bottom irregularities and deadwood shall not be included in calculating the average capacity per unit depth used for the proportional parts table ; and this table shall not be applied in interpolations at these levels.

(ii) The tables may be set out more fully; this may be justifiable in some cases where the greatest speed in calculation is decided, but it shall be remembered that a table set out on a single sheet of paper is often quicker in use than one which occupies several pages.

(iii) It should be remembered that, at best, no oil measurement can be relied upon to nearer than one part in 10,000. Commercial tables should never be set out to show any fractions of a litre, and minor discrepancies within this limit shall be disregarded.

(iv) In general, therefore, it is recommended that tables should be set out to show litres at intervals of 5 cm in dip with a proportional parts table for intermediate dips, the latter being set out against millimetres.

(v) A recommended format of a calibration chart for butt welded tanks is given in the Table.

## SECTION I—STRAPPING METHOD

**4. Corrections to be applied to Measured Circumferences:**

(a) *Step-Overs*:

(i) For each obstruction the excess or deficiency of the tape measurement spanning the obstruction as compared with the 'step-over' interval for the course (ring) concerned shall be subtracted from or added to the circumference figure obtained by strapping, and the result shall be taken as the corrected circumference, free from error due to the displacement of the tape from its proper path by the obstruction concerned.

(ii) Step over correction shall be included for all vertical seams where it is detectable in the case of vertical seams, provided that the tape path used was entirely clear of rivet heads, an average step-over correction may be determined for each course (ring) and multiplied by the number of seams per course (ring) to obtain the total correction to be applied to the measured circumference of that course (ring) to compensate for such overlaps.

(iii) For single obstructions, only step-over corrections 2 mm or over shall be included.

(iv) The use of the step-over corrects circumferences for the effect on them of vertical seam over-laps but does not correct the tank tables for the effect as deadwood of internal projections of the seam edges. These shall be computed and accounted for as deadwood.

(v) By choosing tape courses in order to avoid appurtenances, use of step-overs could be eliminated to a great extent.

(b) *Plate Thickness*—Plate thicknesses measured shall be recorded to the nearest 0.1 mm.

(c) Temperature Correction—Where the strapping and dipping tapes are calibrated at 20°C, and the tank table is to be corrected for use with the shell at 15°C, from each measured circumference shall be subtracted 0.000 09 times the measured circumference, before the figure is taken into further calculation.

5. **Calculations:**

(a) The mean external circumference of any course (ring) shall be the average of the circumferences measured on it and corrected to the nearest 0.1 mm.

(b) The mean internal circumference of the course (ring) shall then be calculated from the mean external circumference of the course (ring) by substracting from the latter $2\pi$ times the plate thickness in metres.

(c) The open capacity of each course (ring), that is, its capacity without allowing for deadwood shall be calculated as if the course (ring) were a true cylinder of the mean internal circumference determined as under (b) above. This rule shall apply to vertical cylinders of in-and-out, telescopic or shingled construction.

(d) The open capacity of each course (ring) in litres per centimetre of height shall be obtained by using either the following formula or any other mathematically equivalent process:

$$\text{Open capacity in litres per centimetre} = \frac{C^2 \times 10\,000}{4\pi \times 1\,000.028}$$

$$\text{or } 0.795\ 752 \times C^2$$

where

C=the mean internal circumference in metres.

(e) For tanks which are inclined to the vertical, these formulae shall be modified as given in 11.

(f) Specimen calculations are given in 12.

## SECTION II—INTERNAL MEASUREMENT METHOD

6. **Corrections to be applied to diameter measurements:**

(a) Deductions shall be made from the average tape readings obtained in measuring diameters to allow for the effect of sag. The correction Z for sag expressed in metres is given by the formula:

$$Z = \frac{W^2 S^3}{24P^2} = KS^3$$

where

P=pull on tape in kg,
S=span of tape i.e. outside circumference of the tank in m,
W=weight of tape in kg/m, and

$$K = \frac{W^2}{24P^2} = \text{constant}$$

Example :

For a tape 10 mm wide and 0.25 mm thick, made of steel of density 7850 kg/m³, values of K to give the correction in centimetres when the tape is stretched with flat side horizontal, will be :

| P | K |
|---|---|
| 4.4 kg | $8.29 \times 10^{-6}$ |
| 4.5 kg | $7.92 \times 10^{-5}$ |
| 4.6 kg | $7.58 \times 10^{-6}$ |

The above formula gives practically the same results as the equation of the catenary and is less cumbersome.

(b) To the average diameter of each course (ring), corrected for sag, add the length of the dynamometer when registering a pull of 4.5 kg.

(c) Corrections for the effect of stretch are unnecessary because the tension applied is that at which the tape is standardized.

(d) Corrections for temperature shall be made as specified in clause 7 (c).

7. **Calculations:**

(a) The mean diameter measurement will consist of the average, of the separate tape readings corrected for sag, plus the length of the dynamometer.

(b) The procedure, shall therefore, be :

(i) Average the tape readings obtained for each course (ring) by dividing the sum of all these readings on the course (ring) by their number. Round off this average to the nearest 0.1 mm.

(ii) Correct the mean result of (i) for sag as specified in clause 6 (a).

(iii) Add to the result of (ii) the dynamometer length as specified in clause 6 (b).

(c) Where the measuring and dipping tapes are calibrated at 20° C, and the tank table is to be correct for use with the shell at 15° C, multiply the result obtained in b (iii) above by (1—0.000 09), before the figure is taken into further calculation. Round off this figure to the nearest 0.1 mm.

(d) Calculate the open capacity of each course (ring) that is its capacity without allowing for deadwood, as if the course (ring) were a true cylinder of the mean internal diameter determined under (b) above. This rule shall apply to vertical cylinders of in-and-out telescopic or shingled construction.

(e) The open capacity of each course (ring) in litres per centimetre of height shall be obtained by using the following formula or by any other mathematically equivalent process:

$$\frac{D^2 \times \pi}{1\,000.028 \times 4} \text{ or } 0.000\,785\,376 \times D^2$$

where

D = the mean internal diameter in centimetres.

(f) For tanks which are inclined to the vertical, modify these formulae as given in clause 11.

(g) When the level or levels from which oil depths will be measured differ from the datum level from which the tank table is first prepared, correction for difference shall be made in the final table.

(h) Specimen calculations are given in clause 13.

8. **Deadwood:**

(a) The open capacity of each course (ring) shall be adjusted for any deadwood it contains.

(b) The total volume of each piece of deadwood shall be calculated to the nearest litre. In this context, the term 'piece of deadwood' shall include such items as the rivet heads in one line around the tank, taken collectively, as a single 'piece' of deadwood.

(c) The effect of small pieces of deadwood may be neglected provided that (i) the total effect of any such neglect shall not lead to error in the tank tables exceeding 0.005 per cent of the total capacity of the course (ring) in which the deadwood occurs, and (ii) any deadwood so neglected is distributed evenly, or substantially so, over the whole height of the course (ring). In calculating the table, however it shall be permissible to include the effect of any deadwood, however small.

9. **Tank bottoms:**

(a) When the tank bottom is substantially horizontal, for example, when the tank is carried on a level concrete raft or steel structure, then bottom irregularities can be neglected.

(b) When the tank bottom has been calibrated by measuring in suitable known volumes of liquid, the tank table for these levels shall be prepared from these measurements on sound mathematical principles. The highest level and capacity shown in the tank bottom calibration table so prepared shall then be the datum level and capacity from which is to be constructed the rest of the table should be prepared by calculation as described in this section.

10. **Floating-roof tanks** :

Except for the following modifications, tables shall be prepared in accordance with Section I and Section II.

(i) Allowance for deadwood shall be made as described in clause 8.

(ii) The drain line and other accessories attached to the underside of the roof shall be included as fixed deadwood in the position they occupy when the roof is at rest on its supports. The position of these accessories should be specified in the calibration table.

(iii) Two levels shall be defined, both an exact number of centimetre above the datum point from which dip readings will be taken. The first level, designated A, shall be not less than 4 cm and not more than 6 cm below the lowest point of the roof plates when the roof is at rest. The second level, designated B, shall be not less than 4 cm and not more than 6 cm above the free oil surface when the roof is at its lowest oil borne position.

(iv) The floating weight of the entire roof shall include weight of roof plus half the weight of the rolling ladder and other hinged and flexibly supported accessories that are carried up and down in the tank with the roof.

The displaced volume due to roof weight can be easily calculated from :

$$\frac{\text{roof weight in kg}}{\text{Density of the stock in kg/litre at tank temperature}}$$

This displacement, minus the volume of deadwood already accounted for in (ii) above, shall be considered as an item of deadwood applicable to all levels above B. It shall either be entered as such on a supplementary table or taken in to account in the preparation of the final table as a deduction for deadwood at all levels above B. For levels between A and B, the proportion of roof displacement to be taken into account as deadwood may be calculated from the dimensions of the floting roof. These partial displacements shall either be entered as such in the supplementary table as applicable for levels between A and B, or taken into account in preparation of final table. Alternatively, where measured quantities of oil have been admitted to the tank and corresponding levels of the free oil surface determined by dipping, the necessary adjustments to the tank capacity within the range of the level A and B may be computed from this data. The part of the table between level A and level B shall be marked 'not accurate'.

(v) It is considered impracticable to allow in the tank table, for the effects of extraneous matter retained by the roof, varying friction of the roof shoes and varying immersion of roof supports.

33/4377/G.

TABLE
[*See* Clause 3 (v)]

## RECOMMENDED FORMAT OF A CALIBRATION CHART FOR BUTT WELDED TANKS

Tank No. ...............
Code....................
Type....................
Diameter or.............
Circumference...........
Height..................

Proportional parts

| mm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres |
|---|---|---|---|---|---|---|---|---|
| | 00 | 200 | 400 | 600 | 800 | 1 000 | 1 200 | 1 400 |
| 1 | 05 | 05 | 05 | 05 | 05 | 05 | 05 | 05 |
| 2 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 3 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 4 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 5 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| 6 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 7 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| 8 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| 9 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| 10 | 50 | 250 | 450 | 650 | 850 | 1 050 | 1 250 | 1 450 |
| 11 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| 12 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| 13 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| 14 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| 15 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| 16 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| 17 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| 18 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| 19 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 20 | 100 | 300 | 500 | 700 | 900 | 1 100 | 1 300 | 1 500 |
| 21 | | | | | | | | |

| mm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres | cm Litres |
|---|---|---|---|---|---|---|---|---|
| 22 | 05 | 05 | 05 | 05 | 05 | 05 | 05 | 05 |
| 23 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 24 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 25 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 26 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| 27 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| 28 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| 29 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| 30 | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| 31 | 150 | 350 | 550 | 750 | 750 | 950 | 1 150 | 1 350 |
| 32 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 |
| 33 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| 34 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 |
| 35 | 70 | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| 36 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| 37 | 80 | 80 | 80 | 80 | 80 | 80 | 80 | 80 |
| 38 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| 39 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| 40 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| 41 | | | | | | | | |
| 42 | | | | | | | | |
| 43 | | | | | | | | |
| 44 | | | | | | | | |
| 45 | | | | | | | | |
| 46 | | | | | | | | |
| 47 | | | | | | | | |
| 48 | | | | | | | | |
| 49 | | | | | | | | |

Data regarding strapping, dimensions, etc.

Approved by. Signature Date

## 11. Computation of Contents of Tanks Inclined to the Vertical

[See Clauses 5 (e) and 7 (f)]

**Tanks Inclined to the Vertical**

(i) Capacity as determined in clauses 5 (e) and 7 (e) applies to tanks which are vertical. For tanks inclined to the vertical at an angle $\theta$, the open capacity in litres per centimetre of vertical height, is given by :

$$0.795\ 752 \times C^2 \times \sec\theta$$

where $C$=the mean internal circumference in metres,

OR

$$0.000\ 785\ 376 \times D_2 \times \sec\theta$$

where D=the mean internal diametre in centimetres.

Sec $\theta$ may be ignored for angles of tilt upto 1 in 50, this representing a maximum error of 0.02 per cent.

(ii) The corrections specified above shall be applied before the corrections for deadwood are made.

[See Clause 5 (f)]

## 12. Example for strapping method

(a) *Data Obtained by Strapping*

| Course (Ring) No. | Measured External Circum-ferences metres | Step-over Corrections metres | Plate Thick-ness mm | Internal Heights of Courses (Rings) Individual cm | Internal Heights of Courses (Rings) Cumulative cm |
|---|---|---|---|---|---|
| 8 Top | 113.040 | 0.002 | 7 | 187.0 | 1 475.0 |
| 8 Middle | 113.086 | 0.002 | 7 | | |
| 8 Bottom | 113.085 | 0.002 | 7 | | |
| 7 Top | 113.127 | 0.002 | 7 | 179.0 | 1 288.0 |
| 7 Middle | 113.133 | 0.002 | 7 | | |
| 7 Bottom | 113.130 | 0.002 | 7 | | |
| 6 Top | 113.090 | 0.003 | 10 | 190.0 | 1 109.0 |
| 6 Middle | 113.096 | 0.003 | 10 | | |
| 6 Bottom | 113.092 | 0.003 | 10 | | |

| Course (Ring) No. | Measured External Circumferences metres | Step-over Corrections metres | Plate Thickness mm. | Internal Heights of Courses (Rings) | |
|---|---|---|---|---|---|
| | | | | Individual cm | Cumulative cm |
| 5 Top | 113.152 | 0.004 | 13 | | |
| 5 Middle | 113.160 | 0.004 | 13 | 179.0 | 919.0 |
| 5 Bottom | 113.155 | 0.004 | 13 | | |
| 4 Top | 113.085 | 0.010 | 13 | | |
| 4 Middle | 113.092 | 0.010 | 13 | 191.0 | 740.0 |
| 4 Bottom | 113.090 | 0.010 | 13 | | |
| 3 Top | 113.175 | 0.010 | 16 | | |
| 3 Middle | 113.176 | 0.010 | 16 | 178.0 | 549.0 |
| 3 Bottom | 113.170 | 0.010 | 16 | | |
| 2 Top | 113.077 | 0.013 | 18 | | |
| 2 Middle | 113.081 | 0.013 | 18 | 191.0 | 371.0 |
| 2 Bottom | 113.075 | 0.013 | 18 | | |
| 1 Top | 113.187 | 0.015 | 20 | | |
| 1 Middle | 113.189 | 0.015 | 20 | 180.0 | 180.0 |
| 1 Bottom | 113.175 | 0.015 | 20 | | |

(b) *Additional Data*

(i) Deadwood

| Course (Ring) No. | Applicable Height cm | Deadwood | | Total Deadwood in Courses litres |
|---|---|---|---|---|
| | | litres | l/cm | |
| 8 | 1 466 to 1 475 | —350 | —38.889 | |
| 8 | 1 415 ,, 1 466 | —508 | — 9.961 | |
| 8 | 1 350 ,, 1 415 | 2336 | —35.938 | |
| 8 | 1 288 ,, 1 350 | nil | nil | —3 194 |
| 7 | 1 109 ,, 1 288 | nil | nil | |
| 6 | 919 ,, 1 109 | nil | nil | |
| 5 | 740 ,, 919 | nil | nil | |
| 4 | 549 ,, 740 | -195 | — 1 021 | —195 |
| 3 | 371 ,, 549 | —259 | — 1 455 | —259 |
| 2 | 180 ,, 371 | —309 | — 1 618 | —309 |
| 1 | 107 ,, 180 | —145 | — 1 986 | |
| 1 | 51 ,, 107 | + 59 | + 1 054 | |
| 1 | 46 ,, 51 | — 36 | — 7 200 | |
| 1 | 0 ,, 46 | nil | nil | —122 |

(ii) Tape calibration temperature=20° C

(iii) Condition of tank at time of strapping:

| | |
|---|---|
| Water in tank to depth of | 1 400 cm |
| Water temperature | 20° C |
| Density of water at 20° C | 1.000 kg/l |

(c) *Calculation of Corrected Internal Circumferences*

Course (Ring) No. 8 Top

| | |
|---|---|
| Measured external circumference at 20° C | 113.040 0 m |
| Correction for calibration temperature of tape | —0.010 2 m |
| Calculated external circumference at 15°C | 113.029 8 m |
| Step-over correction | —0.002 0 m |
| Correction for plate thickness $7 \times 2\pi = 7 \times 6.283\ 2$mm | —0.044 0 m |
| Corrected internal circumference | 112.983 8 m |

(Calculation for other courses may be done in a similar way)

The corrected internal circumferences for the remaining measurements given above are shown below.

(d) *Calculation of Open Capacity of Courses (Rings)*

| Course (Ring) No. | Corrected Internal Circumference m | Mean Internal Circumference m | Open Capacity of Course (Ring) l/cm | Open Capacity of Course (Ring) litres |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| 8 Top<br>8 Middle<br>8 Bottom | 112.983 8<br>113.029 8<br>113.029 8 | 113.014 | 10 163.48 | 1 900 571 |
| 7 Top<br>7 Middle<br>7 Bottom | 113.070 8<br>113.076 8<br>113.073 8 | 113.073 8 | 10 174.22 | 1 821 185 |
| 6 Top<br>6 Middle<br>6 Bottom | 113.014 0<br>113.020 0<br>113.016 0 | 113.016 7 | 10 163.95 | 1 931 150 |
| 5 Top<br>5 Middle<br>5 Bottom | 113.056 1<br>113.064 1<br>113.059 1 | 113.059 8 | 10 171.70 | 1 820 734 |
| 4 Top<br>4 Middle<br>4 Bottom | 112.983 1<br>112.990 1<br>112.988 1 | 112.987 1 | 10 158.62 | 1 940 296 |
| 3 Top<br>3 Middle<br>3 Bottom | 113.054 3<br>113.005 3<br>113.049 3 | 113.053 0 | 10 170.48 | 1 810 345 |
| 2 Top<br>2 Middle<br>2 Bottom | 112.940 7<br>112.944 7<br>112.938 7 | 112.941 4 | 10 150.41 | 1 938 728 |
| 1 Top<br>1 Middle<br>1 Bottom | 113.036 1<br>113.038 1<br>113.024 1 | 113.032 8 | 10 166.84 | 1 830 031 |
| | | Total | | 14 993 040 |

(c) *Calculation of Net Capacity of Courses (Rings)*

| Oil Dip cm | Open Capacity l/cm | Dead wood l/cm | Net Capacity l/cm |
|---|---|---|---|
| 0 to 46 | 10 166.84 | nil | 10 166.84 |
| 46 to 51 | 10 166.84 | —7.20 | 10 159.64 |
| 51 to 107 | 10 166.84 | +1.05 | 10 167.89 |
| 107 to 180 | 10 166.84 | —1.99 | 10 164.85 |
| 180 to 371 | 10 150.41 | —1.62 | 10 148.79 |
| 371 to 549 | 10 170.48 | —1.46 | 10 169.02 |
| 549 to 740 | 10 158.62 | —1.02 | 10 159.60 |
| 740 to 919 | 10 171.70 | nil | 10 171.70 |
| 919 to 1109 | 10 163.95 | nil | 10 163.95 |
| 1 109 to 1 288 | 10 174.22 | nil | 10 174.22 |
| 1 288 to 1 350 | 10 163.48 | nil | 10 163.48 |
| 1 350 to 1 415 | 10 163.48 | —35.94 | 10 127.54 |
| 1 415 to 1 466 | 10 163.48 | — 9.96 | 10 153.52 |
| 1 466 to 1 475 | 10 163.48 | —38.89 | 10 124.59 |

13. **Example for Internal Measurement Method**

[*See Clause* 7 (h)]

(a) *Data obtained by Internal Measurement*—In this example it is assumed that the same tank as in 12 has been calibrated by internal measurement. The means of each course (ring) of the tape measurements of the internal diameters are as in col. 2 of the table in (d) below.

Dynamometer length at a tension of 4.5 kg = 21.30 cm.

(b) *Additional Data*—All course (ring) height deadwood, etc, are the same as in 12.

(c) *Sag Correction*—For a tension of 4.5 kg, the sag correction for course (ring) No. 1 is: $7.89 \times 10^{-5} \times (35.7878)^3 = 3.61$ cm.

(d) *Calculation of Corrected Internal Diameter*

Course (Ring) No. 1

| | |
|---|---|
| Mean tape reading for diameter | 3 578.78 cm |
| Sag correction (deduct) | 3.61 cm |
| Corrected tape reading | 3 575.17 cm |
| Dynamometer length (add) | 21.30 cm |
| Measured/internal diameter at 20°C | 3 596.47 cm |
| Correction for calibration temperature of tape (deduct) | 0.32 cm |
| Corrected internal diameter at 15°C | 3 596.15 cm |

The corresponding tape readings and corrected internal diameters calculated as shown above for all courses (rings) are tabulated below.

| Course (Ring) No. (1) | Mean Tape Reading (2) cm | Mean Tape Reading for diameter Corrected for Sag and Dynamometer (3) cm | Mean Internal Diameter Corrected for Tape Calibration Temperature (4) cm |
|---|---|---|---|
| 8 | 3 579.75 | 3 597.44 | 3 597.12 |
| 7 | 3 580.92 | 3 598.61 | 3 598.29 |
| 6 | 3 578.90 | 3 596.59 | 3 596.27 |
| 5 | 3 580.12 | 3 597.81 | 3 597.49 |
| 4 | 3 577.50 | 3 595.20 | 3 594.88 |
| 3 | 3 579.47 | 3 597.26 | 3 596.84 |
| 2 | 3 576.95 | 3 593.65 | 3 593.33 |
| 1 | 3 578.78 | 3 596.47 | 3 596.15 |

(e) *Calculation of Open Capacity of Courses (Rings)*

| Course (Ring) No. | Open Capacity of Course (Ring) l/cm | Open Capacity of Course (Ring) litres |
|---|---|---|
| 8 | 10 162.17 | 1 900 326 |
| 7 | 10 168.79 | 1 820 213 |
| 6 | 10 157.37 | 1 929 900 |
| 5 | 10 164.27 | 1 819 404 |
| 4 | 10 149.52 | 1 938 558 |
| 3 | 10 160.59 | 1 808 585 |
| 2 | 10 140.77 | 1 936 887 |
| 1 | 10 156.99 | 1 828 204 |
| | Total | 14 982 077 |

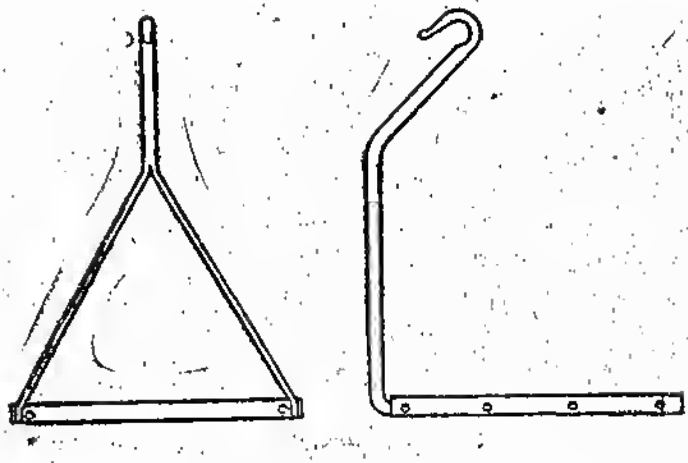
(f) *Calculation of Net Capacity of Course (Ring)*

| Oil Dip cm | Open Capacity l/cm | Deadwood l/cm | Net Capacity l/cm |
|---|---|---|---|
| 0 to 46 | 10 156.69 | nil | 10 156.69 |
| 46 to 51 | 10 156.69 | — 7.20 | 10 149.49 |
| 51 to 107 | 10 156.69 | +. 1.05 | 10 157.74 |
| 107 to 180 | 10 156.69 | — 1.99 | 10 154.70 |
| 180 to 371 | 10 140.77 | — 1.62 | 10 139.15 |
| 371 to 549 | 10 160.59 | — 1.46 | 10 159.13 |
| 549 to 740 | 10 149.52 | —.1.02 | 10 148.50 |
| 740 to 919 | 10 164.27 | nil | 10 164.27 |
| 919 to 1 109 | 10 157.37 | nil | 10 157.37 |
| 1 109 to 1 288 | 10 168.79 | nil | 10 168.79 |
| 1 288 to 1 350 | 10 162.17 | nil | 10 162.17 |
| 1 350 to 1 415 | 10 162.17 | —35.94 | 10 126.23 |
| 1 415 to 1 466 | 10 162.17 | — 9.96 | 10 152.21 |
| 1 466 to 1 475 | 10 162.17 | —38.89 | 10 123.28" |

(6) **in Schedule V,—**

**(A) in Part II, in clause 6, after sub clause (g), the following sub clause shall be inserted, namely:—**

"(h) For the purposes of postal transactions class C beam scales may be provided with an open type pan as illustrated in Fig. 11.



OPEN TYPE PAN

Fig. 11

**(B) after Part II, the following Part shall be inserted, namely:—**

"PART II-A

PORTABLE SCALE FOR JEWELLERS

**1. General:**

This Part deals with the requirements of portable scale for jewellers for weighing diamonds, pearls and other jewels.

**2. Definitions:**

For the purpose of this Part, portable scale for jewellers shall mean equal armed beam scale of capacity not exceeding 100 carats.

**3. Capacity:**

Portable scales for jewellers shall be of capacities 10, 20, 50 and 100 carats.

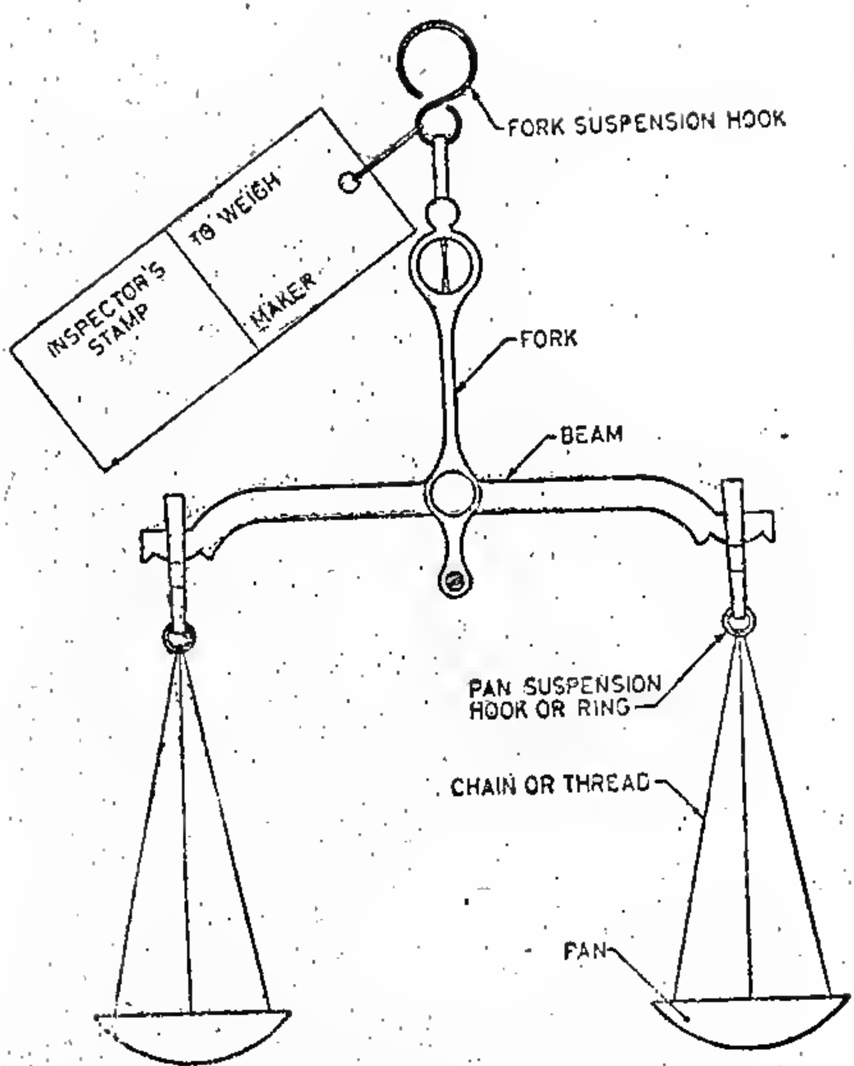



FIG. 1. NOMENCLATURE OF JEWELLERS' SCALES

**4. General Requirements**:

(a) The beam shall be made of aluminium, brass, nickel-silver mild steel or stainless steel.

(b) The beam shall be of swan neck type or box end type.

(c) The pans shall be made of aluminium, brass, bronze, nickel-silver or stainless steel. The pans shall be hung by wire stirrups, chains of aluminium, brass, bronze, nickel-silver or stainless steel or by thread of silk or nylon.

(d) All the three knife-edges, in the case of both swan neck and box end type scales, shall be hardened steel.

(e) The central fork shall incorporate hardened steel bearings of bush type, firmly fitted and secured.

(f) The pan suspension shall be hooks of figure 8 or rings and made of hardened steel.

(g) The beam shall be fitted with an indicator (pointer) on the top in the centre, with sufficient length to show appreciable deflection. It shall be made of aluminium, brass; bronze, steel or stainless steel wire and firmly fitted in to the beam.

(h) The central fork shall have a suspension hook to suspend the scale freely in use.

(i) The fork suspension hook shall also carry a metal label for markings as specified under clause 7.

(j) The fork suspension hook shall be brazed at its ends to prevent the above fork suspension or label being easily removed. The label shall be made of aluminium, brass, bronze, copper, nicckel silver or stainless steel sheet.

(k) The scale shall have a pocket carrying case to prevent damage to it.

**5. Leading Dimensions**:

The leading dimensions for portable scales for jewellers shall be as specified in Table 1.

TABLE-1

LEADING DIMENSIONS FOR PORTABLE SCALES FOR JEWELLERS

| Capacity<br>Carat | Length of Beam Nominal<br>mm | Cross-Section of Beam (Depth X Thickness), Nominal<br>mm x mm | Pan Diameter Nominal<br>mm |
|---|---|---|---|
| 10 | 70 | 3 x 2 | 20 |
| 20 | 80 | 4 x 3 | 25 |
| 50 | 90 | 4 x 3 | 30 |
| 100 | 100 | 5 x 4 | 35 |

*Note*:—Permissible variation ± 10 per cent of the dimensions.

6. **Tests:**

(a) The beam shall remain horizontal without load when in equilibrium.

(b) In the case of beams with detachable suspension hooks and pans, when interchanged, the beam shall maintain its equilibrium at no load.

(c) The scale shall be tested for sensitiveness and error when loaded in each pan with full load equivalent to its capacity.

(d) The limits of sensitiveness and error for portable scales for jewellers at full load shall be as given in Table 2.

TABLE-2

LIMITS OF SENSITIVENESS AND ERROR FOR PORTABLE SCALE FOR JEWELLERS

| Capacity Carat | Sensitivity Cent | Error at full load Cent |
|---|---|---|
| 10 | 0.5 | 1 |
| 20 | 0.5 | 1 |
| 50 | 1 | 2 |
| 100 | 1 | 2 |

7. **Markings**:

(a) The metal label fixed in the fork suspension hook shall be 50 mm x 20 mm (see Fig. 1). It shall be marked on one half side with the capacity and the maker's name. The other half shall be left blank for receiving the Inspector's stamp.

(b) The capacity shall be inscribed on the metal plate in the following manner.

'To weigh.................c'

8. **Seal**:

The Inspector's stamp shall be put on the metal label mentioned in clause 4 (i)";

(C) in Part V, in clause 2,—

(i) before the figures and letters "50 kg", the following figures and letters shall be inserted, namely:—

"10 kg, 20 kg";

(ii) in Table I, before the entries "50", in column (1) "250 g," in column (2) and "60g" in column (3) the following entries shall respectively be inserted, namely:—

| (1) | (2) | (3) |
|---|---|---|
| "10 kg | 50 g | 12.5 g |
| 20 kg | 100g | 25 g" |

(iii) for Table 2, the following Table shall be substituted, namely:—

"TABLE 2

SENSITIVENESS AND ERRORS FOR PLATFORM MACHINES

| Capacity | Sensitive-ness when fully loaded | Verification: Greatest error allowed in excess or in deficiency when fully loaded for — Non-dial type machines | Verification: Greatest error allowed in excess or in deficiency when fully loaded for — Platform machines fitted with dials | Inspection: Sensitiveness when fully loaded | Inspection: Greatest error allowed in excess or in deficiency when fully loaded for — Non-dial type machines | Inspection: Greatest error allowed in excess or in deficiency when fully loaded for — Platform machines fitted with dials |
|---|---|---|---|---|---|---|
| 10 kg | 2 g | 4 g | A weight corresponding to one half the interval between consecutive minimum graduations. | 6 g | 8 g | A weight corresponding to the interval between consecutive minimum graduations. |
| 20 kg | 4 g | 8 g | | 12 g | 16 g | |
| 50 kg | 10 g | 20 g | | 30 g | 40 g | |
| 100 kg | 20 g | 40 g | | 60 g | 80 g | |
| 150 kg | 30 g | 60 g | | 90 g | 120 g | |
| 200 kg | 40 g | 80 g | | 120 g | 160 g | |
| 250 kg | 50 g | 100 g | | 150 g | 200 g | |
| 300 kg | 60 g | 120 g | | 180 g | 240 g | |
| 500 kg | 100 g | 200 g | | 300 g | 400 g | |
| 1000 kg | 125 g | 250 g | | 375 g | 500 g | |
| 1500 kg | 200 g | 400 g | | 600 g | 800 g | |
| 2000 kg | 250 g | 500 g | | 750 g | 1000 g | |
| 3000 kg | 300 g | 1000 g | | 900 g | 2000 g | ". |

(D) in Part VII,—

(i) in clause 2, after the figure and letter "200 t", the following shall be inserted, namely:—
"250 t";

(ii) in Table 1, after the entries "200" in column (1), "1000" in column (2) and; "250", in column (3) the following entries shall respectively be inserted, namely: –
"250 1250 312";

(iii) in Table 2, after the entries "200 9.0 19.0 27.0 38.0", the following entry shall be inserted, namely:—
"250 12.0 25.0 36.0 50.0";

(E) in Part X, in clause (3),—

(i) for sub-clause (a), the following sub-clause shall be substituted, namely;—

"(a) Self-indicating and semi-self indicating machines shall be so constructed as to:

(i) Provide a clear and legible indication,

(ii) ensure that the horizontality of the weights receptor, where provided, and the goods receptor is maintained throughout the range of movement,

(iii) incorporate a suitable damping device";

(ii) for sub-clause (c), the following sub-clause shall be substituted, namely:—

"(c) The pivots, knife-edges, bearing surfaces and all points of contact, where provided, shall be made of hardened steel or agate and shall be so fitted as to allow free movement of the weighing mechanism".

(iii) for sub-clause (e), the following sub-clause shall be substituted, namely:—

"(e) The indicator scale shall be graduated into divisions of equal weight-value and the distance between minor graduations shall be not less than—

(i) 1.25 mm for dial indicators, and

(ii) 2 mm for indicators with optical projections.

On circular dials, the distance between minor graduations shall be uniform. On fan-shaped and linear dials, the distance between minor graduations may be variable but the greatest distance shall not be more than 1.2 times the smallest. The weight corresponding to the distance between the minor graduations shall not exceed the values shown in Table I.

The extremity of the pointer shall not exceed 1 mm in width and shall not be more than 3 mm away from the face of the dial. The position of the pointer, at no load shall be clearly indicated by the zero mark.";

(F) after Part XI, the following Parts shall be inserted, namely:—

"PART XII

TOTALISING WEIGHING MACHINES

1. **Definitions:**

(a) Totalising Hopper Weighing Machine—A totalising weighing machine in which the load is divided into a succession of discrete equal or unequal individual loads, which are weighed in a hopper, grap or other receptacle.

(b) Continuous Belt Conveyor Weighing Machine—A totalising weighing machine in which the load is carried on an endless flexible belt supported by a roller or rollers attached to the weighing mechanism.

2. **General Requirements**:

(a) Removable Parts—Every readily removable part of a machine, the removal of which would affect the correctness of the machine shall be so made and fitted that it is securely located in its operating position. A part shall be deemed to be readily removable if it is possible to remove it without the use of a tool.

(b) Adjusting Mechanism—Any adjustable part or mechanism shall be secured or protected so that it shall not be altered without the use of a tool or accidentally put out of order during normal working.

(c) Manual Controls—All manual controls, the operation of which might effect premature discharge, shall be inoperable whilst the weighing machine is in operation.

(d) Minimum Weight Increment—The minimum weight increment of the totalizing register or indicator shall not exceed:

| | |
|---|---|
| (i) For totalizing hopper weighing machine: | 1/25 of maximum load. |
| (ii) For continuous belt conveyor weighing machine: | Maximum rate of weighing in tonnes per hour/10,000. |

**3. Test for Accuracy**:

(a) The accuracy of the totalising register or indicater shall be tested as follows and shall be within the limits specified under clause 3 (b).

(i) For totalising hopper weighing machines—A total test load equal to not less than forty times the maximum load for which it is designed shall be reweighed on another instrument (the accuracy of which has been previously verified by the Inspector). The total test load shall be built up from individual loads varying from the minimum load marked on the machine to the maximum. Where the foregoing test is not practicable, the machine shall be tested by the application of standard weights.

(ii) For a continuous belt conveyor weighing machine—A total test load equal to not less than 500 times the minimum weight increment of a totalizing register or indicator shall be reweighed over another instrument (the accuracy of which has been previously verified by the Inspector). If the machine is capable of operating at various speeds of operation it shall be tested at the maximum reasonable speed and at the minimum.

(b) Limits of Errors—The error in excess or in deficiency shall not exceed 0.5 per cent of the total test load passed over the machine.

**4. Marking and Identification of Parts**:

(a) Rate of Weighing—Every totalising weighing machine shall be clearly marked with the maximum and minimum rates of weighing for which it is designed, and with the maximum weight per weighing cycle or maximum instantaneous load it is designed to carry. The marking shall be in letters and figures of uniform size of a minimum height of approximately 5 mm.

(b) Removable Parts—Every readily removable part, the removal of which would affect the correctness of machine shall be numbered or otherwise identified with the machine to which it belongs.

(c) Loose Counterpoises—Loose counterpoises, when used for counter balancing, shall be clearly and indelibly marked together with their equivalent weights and shall be numbered to identify with the machine to which they belong.

## PART XIII

## BABY WEIGHING MACHINE

**1. Definition :**

A baby weighing machine shall mean a weighing machine with a pan to receive the baby to be weighed. A typical baby weighing machine is illustrated in Fig: 1.

**2. Capacity :**

The machine shall have a maximum capacity of 10, 15 or 20 kg.

**3. General Requirements :**

(a) The pan for the baby shall be either an oval or a rectangular basin, or an open ended trough of the following approximate dimensions :

| | | Minimum Dimensions (mm) |
|---|---|---|
| Length | .. | 550 |
| Width | .. | 300 |
| Depth | | |
| Basin type | .. | 100 |
| Trough type | .. | 125 |

(b) The pan shall be smooth, non-porous, readily cleanable and of adequate strength and should preferably be made of a low heat-conducting material. Wicker-work shall not be used in the construction of the pan.

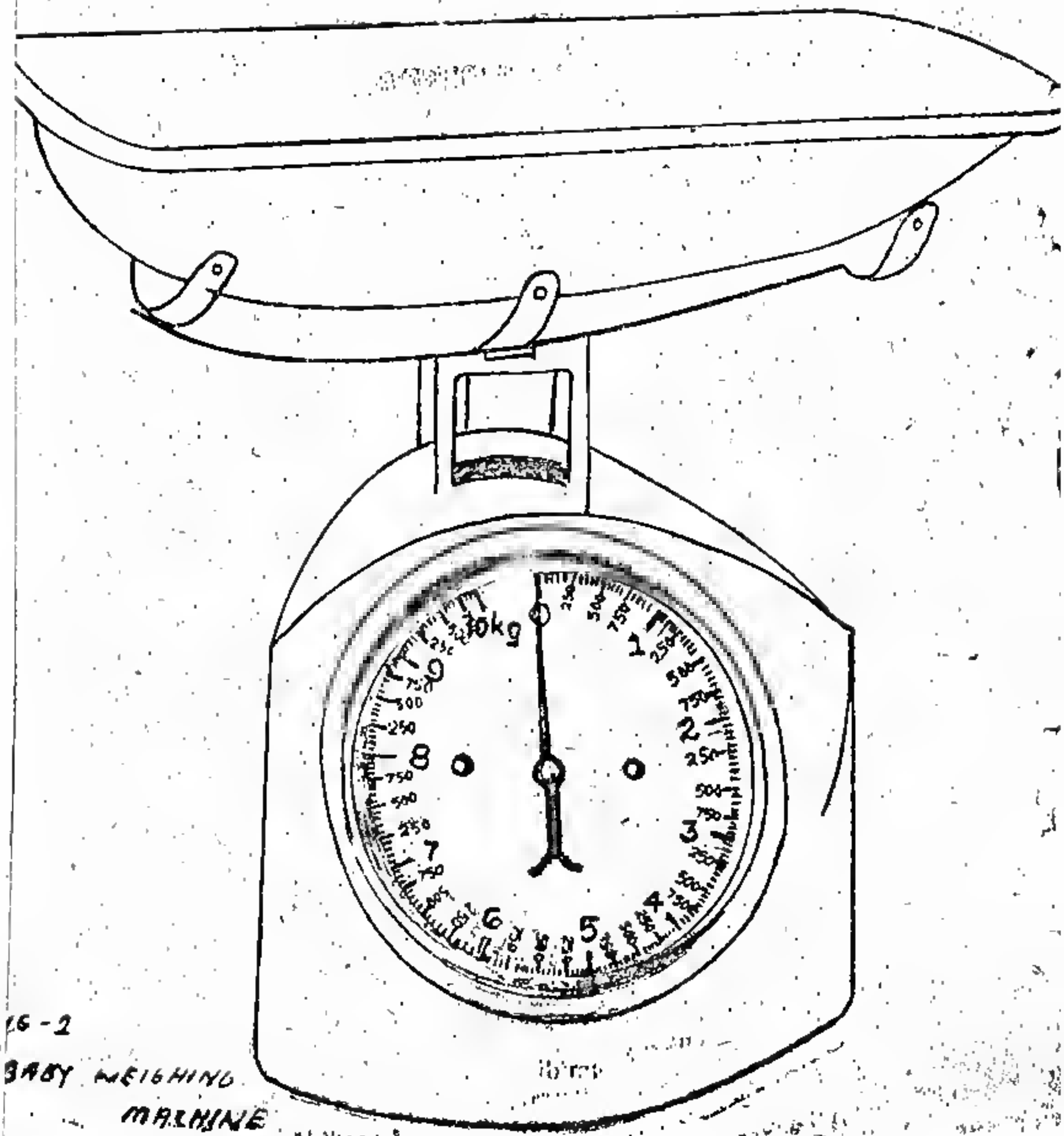
(c) Counter type baby weighing machines shall be provided with hard rubber or fibre stops to prevent noise or 'jar' in the out-of-balance position.

(d) All machines shall be so constructed as to enable a direct net weighing to be obtained.

(e) Baby weighing machines of the spring balance, self-indicating or semi-self-indicating types shall be fitted with efficient oscillation control devices.

(f) In spring-balance, self-indicating or semi-self-indicating type of baby weighing machines the dial shall be graduated into equal parts and the minimum distance between consecutive graduations shall be not less than 2mm. Provision of a screw for adjustment of the pointer to correct zero error shall also be provided.

(g) The extremity of the pointer shall not exceed 1.0 mm. in width and shall be not more than 3.0 mm, away from the graduations on the dial. The weight corresponding to the interval between consecutive graduation marks shall not exceed 50 g.




G - 2
BABY WEIGHING MACHINE

(h) The base of the machine shall be wide and heavy to avoid tilting and the position of the index when there is no load, shall be clearly indicated by a zero mark.

(i) When the weighing machine is provided with an adjustable pointer, the range of adjustment shall not exceed one per cent of the capacity of the machine.

4. **Tests:**

(a) In spring-balance, self-indicating or semi-self-indicating type of machines, the permissible error shall not exceed the weight corresponding to half the interval between consecutive graduations.

(b) When a load equal to half the capacity of the machine is placed at the farthest point from the centre of the pan and the other half at any position the machine shall be correct to the prescribed limit of error.

(c) Each graduation of the machine shall he tested.

(d) For counter type machines, the sensitivity and the greatest error shall he as under :

| Capacity | Sensitiveness when fully loaded | Greatest Error in Excess or Deficiency when fully loaded | |
|---|---|---|---|
| | | Verification | Inspection |
| kg | kg | kg | kg |
| 10 | 7.0 | 10.5 | 21 |
| 15 | 8.0 | 12.0 | 24 |
| 20 | 9:0 | 13.5 | 27 |

(e) The machine shall be correct whether the test is made by progressively increasing or decreasing loads provided that in either case the machine is allowed to vibrate before the reading is taken.

(f) The spring-balance type machine shall he loaded to its full capacity and the load maintained for a period of 24 hours after which it shall be removed. Four hours after removal of the load, the balance shall not show any permanent set. Further, when tested as stated in clause 4 (e), it shall record correct readings.

5. **Sealing:**

Each machine shall he provided with a plug or stud of soft metal on a conspicuous part of the beam or the body for receiving a seal. Such a plug or stud shall be made irremovable by undercutting it or by some other suitable method.

## PART XIV

## WHEEL WEIGHERS

**1. General.**

This Part deals with the requirements for steelyard type and dial type wheel weighers of capacities 1, 3, 5, 10 and 15 tonnes. The steelyard type wheel weighers may be provided with proportional weights and/or sliding weights

**2. General Requirements:**

(a) The wheel weigher shall comply with the general requirement specified in Part I of this schedule. In addition, it shall comply with requirement given in clauses 2 (b) and 2 (c).

(b) *Steelyard*—In the case of steelyard type wheel weigher, the steelyard shall not have any readily removable parts except the support or the proportional weights. One or more stops shall be provided to prevent the sliding poise or poises from travelling past the zero mark.

(i) The top and bottom of the guide and/or steelyard shall be fitted with non-magnetic material.

(ii) When steelyard is provided with notches they shall be suitably protected.

(iii) In the wheel weigher provided with more than one bar, the value of the interval between successive graduations on the minor bar shall not exceed the greatest error allowed for that capacity as specified in the Table.

(c) *Dial Type*—In dial type machines, the racks and pinions shall be of suitably hard wearing material and shall be finished smooth.

(d) *Graduations*—The value of the interval between successive graduations on dials or minor steelyards and major steelyards of weighing instruments shall be such that it corresponds to one of the weights in the series 1, 2 and 5 or its decimal multiples.

**3. Proportional Weights:**

(a) Proportional weights shall be hexagonal in shape with a slot of suitable size to allow them being placed on the counterbalance.

(b) The proportional weights shall be made of cast iron or brass.

(c) The proportional weights shall have one rectangular loading hole which shall be under-cut or tapering outwards, so as to hold the lead securely for adjustments. The surface of the lead in the loading hole of a new proportional weight shall be at least 3mm inside from the bottom surface of the weight.

(d) The smallest denomination of the proportional weight shall be equivalent to the weight represented by the maximum graduation on the minor bar.

(e) The denominations of the proportional weights shall be chosen from the series of weights conforming to 1, 2, 5 and their decimal multiples. Further, any number of proportional weights in any one of the aforesaid denomination may be included provided the total equivalent of all the proportional weights does not exceed the capacity of the weighing instruments.

*Note* :—While arriving at the capacity of the wheel weigher, the maximum graduation shown on the steelyard in the case of 'loose weight' type wheel weighers and on the minor bar in the case of 'no loose weight' type wheel weighers shall not be taken into account.

**4 Tests and Test Methods :**

(a) The range of balancing or adjusting arrangement shall not exceed two per cent of the capacity of the machine. Wheel weighers of the steelyard type shall be tested for sensitiveness and error at full load and shall comply with the requirments specified in Col. 2 and 3 of the Table. Wheel weighers of the dial type shall be tested for error at full load and shall comply with the requirements specified in Col. 4 of the Table. The wheel weighers may be tested for accuracy by any of the methods given in clauses 4 (b) to 4 (d).

(b) *Weigh-Bridge Test Method*

(i) The machine shall be correctly adjusted to zero.

(ii) A pair of the machines shall be laid in such a way that one shall be on the platform of a weigh-bridge and one off the weigh-bridge platform. (If necessary a dummy may be used in place of the other machine.)

(iii) A pair of wheels shall be driven on to the wheel weighers. The load on one of the wheels is then recorded simultaneously by the weigh-bridge and the axle weigher. The other three wheels of the vehicle are clear off the weigh-bridge platform.

(iv) The weighers shall be loaded with increment of heavy, loose materials, so as to show indications on the weigh-bridge corresponding to the number graduations on the wheel weigher to the highest practicable amount.

(v) The readings of the wheel weigher shall be compared with the weigh-bridge indications allowing plus or minus tolerance as laid down in the Table and the necessary allowances shall be given for the error, if any, of the weigh-bridge used for testing wheel weigher.

TABLE

SENSITIVENESS AND ERRORS FOR WHEEL WEIGHERS
[Clauses 2 (b) (iii), 4 (a) and 4 (b) (v)]

| Capacity | Verification | | | Inspection | | |
|---|---|---|---|---|---|---|
| | Sensitiveness when fully loaded | Greatest error allowed in excess or in deficiency when fully loaded | | Sensitiveness when fully loaded | Greatest error allowed in excess or in deficiency when fully loaded | |
| | | For steel-yard type machines | For dial type machines | | For steel-yard type machines | For dial type machines |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Tonne | kg | kg | kg | kg | kg | |
| 1 | 1 | 2 | A weight corresponding to one-half the interval between consecutive graduations. | 3 | 4 | A weight corresponding to the interval between consective graduations. |
| 3 | 2 | 4 | | 6 | 8 | |
| 5 | 3 | 6 | | 9 | 12 | |
| 10 | 5 | 10 | | 15 | 20 | |
| 15 | 5 | 10 | | 15 | 20 | |

(c) *Calibrated Lever Test Method*

(i) The instrument shall be placed on the calibrating platform with the calibrating lever in position adjusted to zero.

(ii) Test weights shall be added to the calibrating lever in ratio to the graduations on the steelyard or dial of the instrument,

(iii) The instrument shall be tested at each numbered graduation upto and including one tonne or such smaller amount as the last graduation on the steelyard indicator or dial may show. The instrument shall be tested upto its maximum capacity. All loose counterpoises and proportional weights relating to the instrument should be tested.

(*d*) *Wheel Weigher Test Method*

(i) Wheel weigher testing machine of suitable capacity and with an interval between successive graduation corresponding to 5 kg or less shall be used.

(ii) The wheel weigher shall be kept on the platform of the machine and the zero of both testing machine and the wheel weigher adjusted. The wheel weigher shall then be loaded with the help of the loading wheel and readings of the wheel weigher and testing machine shall be compared as specified in clause 4 (b) (v).

**5. Identification of Parts:**

(a) Detachable parts which may affect the accuracy of the wheel weighers shall be indelibly numbered or marked so as to facilitate identification.

(b) All loose proportional weights shall be identified with the machine by a number or any other suitable mark of identification which shall be indelible.

**6. Sealing:**

(a) Dial machines shall be fitted with soft metal plug or stud for receiving the seal of the verification authority and wherever practicable, this plug shall be passed through the dial and the frame. The plug or stud fitted on the dial shall be so supported as to allow no risk of damage to the instrument.

(b) On wheel weighers other than those of dial type a plug or stud shall be provided in a conspicuous position on the indicating lever or steelyard.

## Part XV

## KITCHEN SCALES

**1. General:**

(a) This part deals with the requirements of kitchen scales which are intended for measuring quantities of commodities for cooking purposes and other uses where great accuracy is not required.

(b) Kitchen scales shall not be used in any transaction for trade or commerce.

(c) Kitchen scales shall be verified before sale, and may be reverified, if the user so desire.

**2. Definition:**

A kitchen scale shall mean a weighing instrument having a goods pan and a graduated scale, which can be used for weighing commodities or ingredients for cooking purposes.

**3. Capacity:**

The capacities of kitchen scales shall be as specified in the Table.

**4. General Requirements:**

(a) The body, the pan or scoop and components of the kitchen scale shall be constructed of suitable quality steel, non-ferrous metal or shock-absorbing plastic material, sufficiently strong to withstand normal use, and capable of being easily cleaned. All steel parts shall be suitably protected to prevent rusting but the protective coating shall not be deleterious to health.

(b) The pan or scoop shall be easily removable and shall be smooth and capable of being cleaned easily. It shall not tip over when evenly filled. The scoop, if provided, shall have a cubic capacity of not less than one litre. It shall incorporate devices for pouring out easily the commodities weighed or measured in it.

(c) The scoop may also be provided with approximate volume indications. These indications may be accurate to within 10 per cent of the indicated volume.

*Note*:—The volume may not be verified on every kitchen scale, but only on a few pieces in a lot.

(d) The indicating device shall be divided into graduations representing equal weights. The distance between the lines representing the minimum graduation shall be;

(i) not less than 1.25 mm, if the graduations are read directly, and

(ii) not less than 2 mm, after magnification, if a magnifying device is provided.

(e) The weight corresponding to the minimum graduation shall not exceed the values given in the Table

(f) The value of graduation shall be indicated only in metric units and shall be equal to a number of kilograms expressed by one of the following formulae:

$$1 \times 10^n, \quad 2 \times 10^n \text{ or } 5 \times 10^n$$

where $n$ represents either zero or a whole number, positive or negative.

(g) The total number of graduations shall not be less than 100 but not more than 1000,

(h) The dial and pointer may be enclosed by a suitable lens to increase legibility of the reading.

(i) The graduation lines shall be of reasonably uniform thickness throughout their length.

(j) Every fifth graduation line shall be longer and at least every tenth graduation line shall be numbered.

(k) The pointer may preferably be in a contrasting colour to the graduation lines and the dial. The pointer may meet the graduation lines and may cover but not obscure them. The width of the tip of the pointer shall not exceed the thickness of the graduation lines.

(l) Where the scale is graduated at every 20 g, graduation lines to indicate *odd multiples* of 50g may be provided on the side opposite to that bearing graduation lines of 20g.

(m) When the graduation commences at a fixed load, the position of the pointer, when there is no load, shall be clearly indicated by a zero mark.

(n) The scale may be provided with a zero setting device. The range of adjustment of the zero setting device, if provided, shall not exceed ten per cent of the capacity of the scale.

*Note*:—The large range of adjustment is provided to accommodate the tare of other containers which might be placed on the pan for recei-ving viscous or other materials..

(o) The scale shall be provided with a device to prevent the effect of any overloading which may adversely affect its metrological qualities.

5. **Tests**:

(a) The scale shall be tested on a hard, flat and level surface.

(b) The difference on return to zero, immediately after removing a load, equal to the capacity, kept on the instrument for half an hour shall not exceed half the value of the minimum graduation.

(c) The maximum permissible error at any load upto full capacity shall not exceed the limits specified in the Table, at the time of initial verification.

(d) The scale shall be correct within the maximum permissible errors, whether the test is made by progressively increasing or decreasing loads specified in the Table provided that, in either case, the spring, if provided, shall be allowed to vibrate before the reading is taken.

(e) When a weight equal to a quarter of the maximum capacity is moved from the centre of the scoop or pan in any direction to a distance of 50 mm, the scoop or pan shall not tip or topple.

(f) The difference between the results of several weighments of the same test load shall not exceed the maximum permissible error for that load.

(g) Five per cent of one lot of kitchen scale shall be initially verified by placing a test load equal to the full capacity of the instrument, for a period of about 8 hours. The difference between the indication obtained immediately after depositing the load and the constant indication obtained 8 hours later shall not exceed the maximum permissible error for that load.

(h) When tested for model approval, the kitchen scale shall not show an error exceeding twice the maximum permissible error, after being subjected to 7,500 weighings at full load. These weighings shall be made in quick succession but shall be limited to not more than 20 weighings per hour.

(i) The standard test weights used for the verification of the scale shall not be inaccurate by a relative error of more than 0.3 times the maximum permissible error of the scale for the given load.

6. **Sealing** :

Kitchen scales shall be provided with a soft plug, at a suitable place, to receive the Inspector's stamp and this plug shall pass through the frame. The plug shall be so supported as to allow no risk or damage to the instrument.

TABLE

CAPACITIES, GRADUATIONS AND MAXIMUM PERMISSIBLE ERRORS FOR KITCHEN SCALES

| Capacity | Maximum weight corresponding to the distanee between minimum graduations | Test load | Maximum permissible error, at initial verification |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 1 kg | 10 g | From 0 upto and including 500 g | ± 5 g |
| | | Above 500 g | ± 10 g |
| 2 kg | 20 g | From 0 upto and including 1 kg | ± 10 g |
| | | Above 1 kg | ± 20 g |
| 5 kg | 50 g | From 0 upto and including 2.5 kg | ± 25 g |
| | | Above 2.5 kg | ± 50 g |

*Note*:—The maximum permissible errors at the time of reverification, if any, shall be double of those specified in the Table.

PART XVI

# TUBULAR BALANCES

**1. General:**

This Part deals with the requirements for tubular balances with graduated scale.

**2. Definitions :**

A tubular balance shall mean a weighing instrument, which on the application of the load to be weighed, indicates the weight of the load by the extension of a spring, such extension being indicated by means of a pointer on a graduated scale, which is longitudinally marked on the tube.

**3. Capacities :**

The capacities and the maximum permissible errors on tubular balances shall be as specified in the Table.

**4. General Requirements**

(a) The body of the instrument shall be made or manufactured from hrass, bronze, aluminium, mild steel or any other suitable material but the tubes shall be made or manufactured from non-rusting material only. The body of the balance shall be robust in construction.

(b) If a pan or a scoop is provided, it shall be made of brass, bronze, aluminium, mild steel, stainless steel or polystyrene metal. Chains, hooks or metal supports shall oe provided if the pan or scoop is suspended. When the pan is made or manufactured from mild steel it shall be suitably protected against corrosion.

(c) The indicating device shall be divided into graduations representing equal weights into equal divisions and the distance between the lines representing the minimum graduation shall be not less than 1.25 mm.

(d) The weight corresponding to the minimum graduation shall not exceed the values given in the Table.

(e) When the graduation commences at a fixed load, the position of the pointer, when there is no load, shall be clearly indicated by a zero mark.

(f) The tubular balance shall be suspended permanently from a stand, support or bracket.

(g) The scale shall be provided with a device to prevent the effect of any over-loading which may adversely affect its metrological qualities.

**5. Tests :**

(a) The maximum permissible error shall not be exceeded when the load is applied (on hook or in pan or scoop) (*See* the Table).

(b) Each graduation shall be tested for accuracy.

(c) The balance shall be correct, whether the test is made by progressively increasing or decreasing loads, provided that, in either case the spring shall be allowed to vibrate before the reading is taken.

(d) The difference between the results of several weighments of the same test load shall not exceed the maximum permissible error for that load.

(e) The balance shall be loaded to its full capacity and the load maintained for a period of 24 hours after which it shall be removed. Four hours after removal of the load, the balance shall not show any permanent set. Further, when tested as stated in sub-clause (c) of this clause, the balance shall record correct readings.

(f) The tubular balance shall not be tested for sensitiveness.

(g) The standard test weights used for the verification of the scale shall not be inaccurate by a relative error of more than 0.3 times the maximum permissible error of the scale for the given load.

**6. Sealing :**

A provision shall be made to seal the tubular balance by means of a soft lead plug or wire and wherever practicable this plug shall pass through the frame. The lead plug or wire seal shall be so supported as to allow no risk or injury to the instrument. The Inspector's stamp shall be affixed on the lead plug or on a suitable lead plug in conjunction with the wire.

TABLE

CAPACITIES AND MAXIMUM PERMISSIBLE ERRORS FOR TUBULAR BALANCES

| Capacity | Maximum weight corresponding to the distance between minimum graduations | Maximum permissible error on initial verification |
|---|---|---|
| (1) | (2) | (3) |
| 1 kg | 20 g | ± 10 g |
| 5 kg | 100 g | ± 50 g |
| 10 kg | 200 g | ± 100 g |
| 20 kg | 500 g | ± 250 g |
| 50 kg | 500 g | ± 250 g |

*Note*:—Inspection errors shall be double the values shown in Col. 3

## PART XVII

## BATHROOM SCALES

1. **General :**

(a) This Part deals with the requirements of bathroom scales which are intended to be used for taking the weights of individual persons in a private household.

(b) Bathroom scales shall not be used where many persons are to be weighed frequently such as in schools, hospitals, clinics or by doctors who undertake medical examination for purposes of life insurance or issuing certificates of health etc.

(c) Bathroom scales shall be verified before sale, and may be reverified if the user so desires.

2. **Definition :**

A bathroom scale means a weighing scale with a platform to receive the person to be weighed, a weighing mechanism and a rotating dial or an indicator for automatic indication of the weight.

3. **Capacity :**

Bathroom scales shall have a capacity of not less than 120 kg.

4. **General Requirements :**

(a) The platform, base and the components shall be constructed of suitable quality steel, non-ferrous metal or shock-absorbing plastic material sufficiently strong to withstand normal use. All steel parts shall be suitably protected to prevent rusting.

(b) The indicating device shall be divided into graduations representing equal weights. The distance between the lines representing the minimum graduation shall be :

(i) not less than 1.25 mm, if the graduations are read directly and

(ii) not less than 2 mm, after magnification if a magnifying device is provided.

(c) The weight corresponding to the minimum graduation shall not exceed one kilogram.

(d) The value of graduation shall be indicated in metric units and shall be equal to a number of kilograms expressed by one of the following formulae :

$$1\times10^n, 2\times10^n \text{ or } 5\times10^n$$

where 'n' represents either zero or a whole number, positive or negative.

(e) The total number of graduations shall not be less than 100 but not more than 1000.

(f) The dial and pointer may be enclosed by a suitable lens to increase legibility of the reading.

(g) The graduation lines shall be of reasonably uniform thickness throughout their length.

(h) Every fifth graduation line shall be longer and at least every tenth graduation line shall be numbered.

(i) The scale may be provided with a zero setting device capable of being operated from outside the scale. The range of adjustment of the zero setting device, if provided, shall not exceed 5 kg.

(j) The scale shall be provided with a device to prevent the effect of any overloading which may adversely affect its metrological qualities.

5. **Tests:**

(a) The scale shall be tested on a hard, flat and level surface.

(b) The scale shall be initially loaded to an indication of at least 50 kg and that load shall be maintained for about half an hour. The difference on return to zero immediately after removing the load shall not exceed half the value of the minimum graduation.

(c) After setting the scale at zero after the test in (b) above a pressure of about 5 kg shall be exerted on the platform by hand and then released. If the scale does not return to zero, the scale shall again be set at zero graduation and the procedure repeated until it returns to zero on releasing the pressure.

(d) Test loads, increasing in steps of 20 kg, and evenly distributed over area of the platform, shall be carefully applied upto the full capacity of the scale. The test shall be repeated to provide two readings at each increment of the test load. The arithmetic mean of the two readings at each test load shall not be inaccurate by more than the maximum permissible error for that load.

(e) The difference between the results of several weighments of the same test load shall not exceed the maximum permissible error for that load.

(f) Five per cent of one lot bathroom scales shall be initially verified by placing a test load equal to the full capacity of the instrument, for a period of about 8 hours. The difference between the indication obtained immediately after depositing the load and the constant indication obtained 8 hours later shall not exceed the maximum permissible error for that load.

(g) When tested for model approval, the bathroom scale shall not show an error exceeding twice the maximum permissible error, after being subjected to 2000 weighings at full load. These weighings shall be made in quick succession but shall be limited to not more than 20 weighings per hour.

(h) The standard test weights used for the verification of the scale shall not be inaccurate by a relative error of more than 0.3 times the maximum permissible error of the scale for the given load.

6. *Sealing*:

Bathroom scales shall be provided with a soft plug or a wire-and-lead seal at a suitable place to receive the Inspector's stamp and this plug or wire-and-lead seal shall pass through the frame.

*Note*:—The maximum permissible errors at the time of re-verification, if any, shall be double of those specified in the Table.

TABLE

MAXIMUM PERMISSIBLE ERRORS FOR BATHROOM SCALES

| Test load | Maximum permissible errors at initial verification |
|---|---|
| From 0 kg up to and including 50kg | ±500 g. |
| Above 50 kg | ±1 kg"; |

*Note*:—The maximum permissible errors at the time of reverification if any, shall be double of those specified in the Table.

## PART XVIII

## NON-AUTOMATIC WEIGHING INSTRUMENTS WITH DIGITAL INDICATION AND PRINTING (MEDIUM AND ORDINARY ACCURACY)

1. **Definitions**:

(a) "Non-automatic Weighing Instruments" means weighing instruments which require the intervention of operator during the weighing process, particulraly to deposit the loads on the load receptor or to remove them and also to determine the result.

(b) "Load Receptor" means that part of the instrument which is intended to receive the load.

(c) "Load Measuring Device" means that part of the instrument which measures the mass of the load.

(d) "Zero-Setting Device" means a device for setting the indication of the weighing instrument to Zero when the load receptor is empty.

(e) "Maximum Capacity" (Max) means the maximum weighing capacity of the weighing instrument.

(f) "Minimum Capacity" (Min) means the value of the load below which the weighing results may have an excessive error.

(g) "Weighing Range" means the difference between the maximum and minimum capacities.

(h) "Tare Additive Device" means a device for balancing the tare without intruding on the weighing range of the instrument.

(i) "Tare Subtractive Device" means a device for subtracting the tare from the weighing result, thus reducing the weighing range of the instrument.

(j) "Maximum Tare Additive Effect" means the maximum capacity of the tare additive device.

(k) "Maximum Tare Subtractive Effect" means the maximum capacity of the tare subtractive device.

(l) "Selector Device" means a device for connecting one or more load receptors to one or more load measuring devices.

(m) "Printing Device" means that part of the load measuring device which prints the result of weighment.

(n) "Digital Graduation" (d) means the value, in units of mass, of the difference between two consecutive values of indication or printing.

(o) "Number of Graduations" (n) means ratio of the maximum capacity to the digital graduation.

$$n = \frac{Max}{d_d}$$

(p) "Verification Graduation" (e) means the value expressed in units of mass, used for verification purposes.

(q) "Discrimination" means the value of the smallest additional load which, when placed without any impact, is necessary to change the state of equilibrium of the instrument.

(r) "Repeatability" means ability of an instrument to give identical results when the same load is placed on or removed from the load receptor several times.

(s) "Digital Indication or Printing" means the indication or printing whose graduation marks are generally composed of a series of aligned numbers, which do not permit interpolation to less than a graduation.

(t) "Rounding Error of Digital Indication or Printing" means the difference between the digital indication or printing and the result the weighing instrument would give if the indication or printing were continuous.

(u) "Maximum Permissible Error" means maximum difference, in excess or deficiency, permitted under the rules between weighing result and the mass of the load being weighed, the instrument being previously set at zero at no load.

2. **Units of Measurement**: (In the International System of Units). The basic unit of mass shall be the kilogram (symbol : kg)

*Note*:—The units of measurements for mass used generally are: milligram (mg), gram (g), kilogram (kg) and tonne (t).

3. **Metrological Data:** (Value and number of digital graduation, maximum and minimum capacity and verification graduation).

(a) The weighing instruments shall conform to the metrological data specified in Table 1 and Table 2.

(b) The value of graduation shall be in the form of $1 \times 10^n$, $2 \times 10^n$ and $5 \times 10^n$, 'n' being a positive or negative whole number or Zero

4. **General Requirements :**

(a) *General.—*

1. The weighing instruments shall be robustly and carefully constructed in order to ensure that they maintain their accuracy and metrological qualities while in use.
2. The weighing instrument shall be so designed as to enablethe test and inspection procedures provided in these rules to be carried out.
3. The weighing instrument shall be free from any features which are likely to facilitate fraudulent use.
4. The weighing instrument shall be so constructed that any disorder which may disturb their proper operation is not produced without visible effect.

(b) *Load indication and printing.—*

1. The reading of indicated or printed results of weighment shall be easy and unambiguous.
2. The figures forming the result shall be of a size, shape and clarity allowing easy reading under normal conditions of use. However, the height of the figures of indication shall not be less than 5 mm.
3. The printing of the weighing results shall be clear and indelible.
4. Printing shall be made impossible above the maximum capacity.
5. Printing below the minimum capacity shall only be possible by a clearly apparent special operation.

(c) *Zero-Setting.—*

1. The weighing instrument may be provided with
   - (i) one or more zero-setting devices,
   - (ii) an automatic zero-correction device, or
   - (iii) a combination of one or more zero-setting devices and automatic zero-correction device.
2. If one or more zero-setting devices are provided, the zero position of the instrument shall be capable of being adjusted with the help of (i) a zero setting device and (ii) a zero indicating device.
3. The effect of the zero-setting device shall not be greater than 4% of the maximum capacity of the instrument.
4. The control of the zero setting device shall be separate from that of the tare device if the instrument is provided with both these devices.

5. The zero indicating device shall indicate clearly any deviation from zero exceeding 1/4 digital graduation.

6. Where automatic zero-setting device is provided, its operation shall be impossible when the tare additive device is not at zero.

(d) *Levelling*.—

1. Weighing instruments except the following categories shall be provided with a levelling device and a level indicator:

   (i) freely suspended instruments;

   (ii) instruments installed in a fixed manner; and

   (iii) out-of-level instruments (being out of level by 2% in any direction).

2. The level indicator shall be fixed on the instrument in an irremovable manner, in a place clearly visible to the user.

(e) *Taring*.—

1. If the instrument is provided with a taring device, the indication of the value of tare or a signal showing that the taring device is set in operation shall be clearly visible.

2. When the use of a tare subtracting device obscures the value of the residual weighing range a device shall prevent the use of the machine above its maximum capacity or indicate that this capacity has been reached.

(f) *'Weigh' or 'Lock' position*.—

1. If an instrument has one or more devices for locking the weighing mechanism, these devices shall have only two stable positions corresponding to 'Lock' and 'Weigh' and weighment shall be possible only in the 'Weigh' position.

2. The 'Lock' and 'Weigh' position shall be clearly and conspicuously displayed.

(g) *Selector Devices*.—

1. If the instrument is provided with selector devices, the selector devices shall ensure compensation of inequality of effect, at no load, of the various load receptors on the load measuring device.

2. The zero setting of an instrument in any multiple combinations of various load measuring devices and load receptors shall be capable of being carried out without any ambiguity.

3. Weighment shall be impossible while the selector device is being used.

4. The combination of load receptors and measuring devices used shall be easily identifiable.

(h) *Price Indicating or Printing Devices*.—

Weighing instruments provided with price indicating or printing devices shall comply with the following requirements:

1. When the price to pay is printed, the instrument shall also print the mass, unit price and the identification mark of the machine.
2. Symbols of the monetary unit shall accompany the indication and printing of the price-to-pay and the unit price. This shall also include the symbol of the standard unit of mass to which it refers.
3. Indications of the unit price and price-to-pay must be positioned near the indication of mass.
4. Printing below the minimum capacity shall only be possible by a special operation.
5. It shall not be possible to indicate or print, price--to-pay for unit price less than minimum unit price.
6. Digital indication or printing of the price-to-pay shall include at least 4 figures.
7. Device indicating or printing the price-to-pay shall not normally function when ;
   - (i) the product of the weight mass and its unit price is greater than the maximum price that can be indicated or printed,.
   - (ii) the mass of the load to be weighed is greater than the maximum capacity.

5. **Descriptive Markings :**

(a) Weighing instruments shall carry the following markings :—
- (i) manufacturer's identification.
- (ii) indication of accuracy class in the form of a Roman figure in an oval field,
  for medium accuracy III
  for ordinary accuracy IIII
- (iii) Maximum capacity in the form Max......
- (iv) Minimum capacity in the form Min......
- (v) verification graduation in the form e =......
- (vi) digital graduation in the form of $d_d$=......
- (vii) temperature range within which the instrument is designed to function, ..°C....°C

(b) Weighing instruments provided with a taring device shall carry one of the following descriptive markings as the case may be:
- (i) Maximum additive tare effect in the form T=+......
- (ii) Maximum subtractive tare effect in the form T=—..

(c) Weighing instruments working on electric energy shall carry the following additional descriptive markings :
- (i) electrical supply voltage in the form..V
- (ii) electrical supply frequency in the form......Hz

(d) Descriptive markings shall be indelible and have a size, form and clarity allowing easy reading under normal conditions of use of the instrument.

(e) Descriptive markings shall be grouped together in an easily visible location on the instrument, either on a plate fixed to the instrument or on the instrument itself.

(f) The descriptive markings Max......, Min......, e=......, $d_d$=....shall also be shown close to the indication of the result if all the descriptive markings are not located there.

(g) In the case of weighing instruments having several load receptors and load measuring devices, each load measuring device shall carry markings in respect of the following :

(i) maximum capacity,
(ii) minimum capacity,
(iii) verification graduation,
(iv) digital graduation, and
(v) identification marks, maximum capacity, maximum additive tare effect (if applicable), in respect of each load receptor to which the measuring devices may be connected.

6. **Maximum Permissible Errors**:

(a) *Values of errors.*—

1. The maximum permissible errors may be in excess or in deficiency, the instrument having been adjusted to zero at no load.
2. The values of the maximum permissible errors, expressed in terms of verification graduation (e), shall be as specified in Table 3 and Table 4.

(b) *Variation of results*:

1. For the same load kept on the instruments, the difference between the indication obtained immediately after depositing the load and the constant indication obtained 8 hours later shall not exceed the value of the maximum permissible error specified for that load.
2. The difference on return to zero, immediately after removing the load kept on the instrument for half an hour shall not exceed half the verification graduation (e).
3. The difference between any two results obtained after placing the same load on different positions of the load receptor shall not be greater than the maximum permissible error specified for that load.

7. **Metrological Qualities**:

(a) *Repeatability.*—The difference between the results of several weighments obtained for the same load shall not be greater than the value of the maximum permissible error as specified for that load.

(b) *Discrimination.*—When an extra load equivalent to 1.4 times the digital graduation is placed gently on the instrument, at equilibrium with a test-load just causing a change of indication or printing, it shall cause ½ the sum of the test-load indications or printed results to be increased by at least one digital graduation.

(c) *Sensitivity.*—The concept of sensitivity does not arise in the case of digital printing.

**8. Influence Factors:**

(a) *Temperature*

(1) If no particular working temperature is specified in the operating instruction of an instrument furnished by the manufacturer, it shall meet the requirements specified under clauses 6 and 7 in the range of—10°C to 40°C.

(2) Weighing instruments for which a particular range of working temperature is mentioned in the operating instruction furnished by the manufacturer, shall meet within those limits, the requirements, specified under clauses 6 and 7,
However, the interval between these ranges shall not be less than 30°C.

(3) The instrument shall be such that its indication at no load does not vary by more than one verification graduation (e) for a difference of 5°C in ambient temperature.

(4) The verification of the instrument shall be carried out at a constant temperature within the limits fixed for its operation. The ambient temperature shall be deemed to be constant if the following two conditions are satisfied.

(i) The difference between the highest and lowest temperature observed during the period of testing does not exceed 5°C.

(ii) The difference between the highest and lowest temperature observed during any 5 minutes period shall not exceed 1°C.

(b) *Electric Power Supply.*—Instruments working on electrical energy shall meet the requirements specified in clauses 6 and 7, within limits of variation of the electric power supply between (–) 15 to + 10 per cent of nominal voltage and ± 2 per cent of nominal frequency.

TABLE—1

Metrological Data—Medium Accuracy III

| Value of Graduations ($d_d$) | Number of divisions (n) | Maximum capacity (Max.) | Minimum capacity (Min.) | Verification Graduation (c) |
|---|---|---|---|---|
| 100mg, 200mg, 500mg or 1g | More than or equal to 50 but less than or equal to 10,000 | More than or equal to 5g but less than or equal to 10kg | 10 $d_d$ | $d_d$ |
| 2g or 5g | More than or equal to 200 but less than or equal to 10,000 | More than or equal to 400g but less than or equal to 50kg | 20 $d_d$ | $d_d$ |
| 10g or 20g | More than or equal to 500 but less than or equal to 10,000 | More than or equal to 5kg but less than or equal to 200kg | 20 $d_d$ | $d_d$ |
| 50g, 100g, 200g, 500g, 1kg, 2kg, 5kg or 10kg | More than or equal to 500 but less than or equal to 10,000 | More than or equal to 25kg but less than or equal to 100t | 50 $d_d$ | $d_d$ |
| 20kg, 50kg, or 100kg | More than or equal to 750 but less than or equal to 10,000 | More than or equal to 15t but less than or equal to 1000t | 1000 kg | $d_d$ |
| 200kg, 500kg, 1t, 2t, 5t, 10t ...... | More than or equal to 750 but less than or equal to 10,000 | More than or equal to 150t | 10 $d_d$ | $d_d$ |

*Note*:—The values of graduations specified in the above table are in form of $1 \times 10^n$, $2 \times 10^n$, $5 \times 10^n$, n being a positive or negative whole number or Zero.

### Table—2

Metrological Data—Ordinary accuracy IIII

| Value of Graduation ($d_d$) | Number of divisions (n) | Maximum capacity (Max.) | Minimum capacity (Min.) | Verification Graduation (e) |
|---|---|---|---|---|
| 5g, 10g, 20g, 50g, 100g, 200g, 500g, 1kg, 2kg, 5kg, 10kg | More than or equal to 100 but less than or equal to 1000. | More than or equal to 500g but less than or equal to 10t. | 10 $d_d$ | $d_d$ |
| 20kg, 50kg, 100kg........ | More than or equal to 200 but less than or equal to 1000 | More than or equal to 4t. | 10 $d_d$ | $d_d$ |

*Note*:—The values of graduations specified in the above table are in the form of $1 \times 10^n$, $2 \times 10^n$, $5 \times 10^n$, 'n' being a positive or negative whole number or Zero.

### Table—3

Maximum permissible errors on verification and inspections:—

Medium Accuracy : III.

| Verification | Inspection |
|---|---|
| 1e | 1.5e for loads between zero and 500e inclusive |
| 1.5e | 2.5e for loads between 500e exclusive and 2000e inclusive |
| 2e | 3.5e for loads greater than 2000e |

### Table—4

Maximum permissible error on verification and inspection:—

Ordinary accuracy—IIII

| Verification | Inspection |
|---|---|
| 1e | 1.5e for loads between zero and 50e inclusive |
| 1.5e | 2.5e for loads between 50e exclusive and 200e inclusive. |
| 2e | 3.5e for loads greater than 200e |

*Note*:—(a) The rounding errors allowable has been included in the above tables.
(b) Machines may or may not cover the entire range of graduations indicated above." ;

(7) **in Schedule VI, after Part IV, the following Parts shall he inserted namely:—**

"PART V

METERS FOR LIQUIDS
(OTHER THAN WATER)

1. **General :**

(a) This Part deals with meters for liquids (other than water) in which the liquid being measured causes the displacement of movable walls defining the limits of the measuring chambers, which allow continuous measurement of any volume of liquid.

(b) The expression "meter" designates an instrument consisting only of a "measuring device" and an "indicating device".

(c) Auxiliary devices for meters, as well as measuring assemblies, are the subject of another Part.

2. **Definitions :**

(a) *Minimum delivery*—Minimum delivery is the smallest volume of liquid authorised to be measured through the meter.

(b) *Cyclic volume*—Cyclic volume is the volume of liquid corresponding to one cycle of operation of the measuring device i.e. the sequence of movements at the completion of which all the internal moving parts of the measuring device return for the first time, to the same position as the beginning of the operation.

(c) *Periodic variation*—Periodic variation is the maximum difference which occurs, during one cycle of operation, between the volume cleared by the displacement of the measuring parts and the corresponding volume recorded by the indicator, the latter being connected without play or slip to the measuring device in such a manner that it indicates at the completion of the cycle and for that cycle, a volume equal to the cyclic volume. This variation may be reduced by the introduction of an appropriate correcting device.

(d) *Primary element of an indicating device*—In an indicating device having several elements, that element which carries the scale having the minimum graduation is called "the primary element".

3. **Indicating Device :**

(a) *General Provisions :*

(i) The indicating device, which may have one or more moving elements, shall indicate the measured volumes in cubic centimetres or millilitres, in cubic decimetres or litres, or in cubic metres.

(ii) These are the only units of volume authorised for measurement with metres.

(iii) The reading shall be indicated clearly, quickly and unambiguously. If the device has several elements, the assembly shall be carried out in such a manner that the final reading may be obtained by simple juxtaposition of the readings of different indicating elements.

(iv) The minimum graduation of the primary element shall be $1 \times 10^n$ or $2 \times 10^n$ or $5 \times 10^n$ times authorised units of volume, where 'n' represents a whole number, positive or negative or is equal to zero.

(v) The maximum capacity of the indicator shall be $1 \times 10^n$ or $2 \times 10^n$ or $5 \times 10^n$ times the authorised units of volume, where 'n' represents a whole number, positive or negative or is equal to zero.

(vi) When the graduation of an element is completely visible, the value of one revolution of this element shall be $10^n$ times the authorised units of volume. This principle does not, however, apply to the element which corresponds to the maximum capacity of the indicator.

(vii) On a device having several elements, the value of each revolution of the moving parts of the elements, the graduation of which is totally visible, shall be equal to. the value of the minimum graduation of succeeding element.

(b). *Method of indication* :

(i) An element of the indicating device may be analogue or digital, but when elements other than the primary, have only a portion of their scale visible through windows, those elements shall have digital movement (the primary element may, however, be analogue or digital).

(ii) An element with analogue movement shall have a graduated scale and a pointer to indicate the measured volume at any position of stop.

(iii) When that element is in the form of a fixed circular scale and rotating needle indicator, the direction of the rotation of the needle shall be clockwise.

(iv) In an indicating device having several elements, the advancement of figures of an element with digital movement, other than the primary, shall stop when the preceding element indicates zero. This advancement shall occur when the preceding element makes a fractional rotation not greater than one tenth.

(v) If the indication is given in aligned numbers and the movement of the primary element is digital, the presence of one or more zeros fixed to the right of that element is authorised.

(c) *Graduation* :

(i) Graduation lines on scales shall be of uniform thickness throughout their length. Their thickness shall be not more than a quarter of the length of the graduation.

(ii) The graduations representing $1 \times 10^n$, $2 \times 10^n$ or $5 \times 10^n$ of the authorised units of volume shall be differentiated by their length, where 'n' represents a whole number, positive or negative or is equal to zero.

(iii) The length of the graduation, as actually marked or optically magnified, shall be not less than 2 mm.

(iv) The height of the numerals, as actually marked or optically magnified, shall be not less than 4 mm.

(v) If the primary element has analogue movement and has a moving scale of which only a portion is visible through the window, the width of such window, in the direction of the scale, shall be not less than 1.5 times the distance between two consecutive numbered graduations.

(d) *Operation of mechanical indicator.*—The operation of the indicating device by the measuring device shall be positive and reliable and shall be carried out by means of mechanical connection or through the intermediary of a permanent magnetic device.

**4. Adjusting Devices**:

(a) The meters shall have an adjusting device to change the ratio between the indicated volume and the actual volume of liquid which has passed through the measuring device.

(b) When the adjusting device changes this ratio in a discontinuous manner, the consecutive values of this ratio shall not differ by more than 0.002.

(c) Adjustment by means of a bye-pass pipe on the measuring device is prohibited.

**5. Special provisions relating to minimum delivery**:

(a) Minimum delivery shall be determined in such a manner that the maximum permissible error on that delivery [see clauses 8 (a) and 8 (b)] is more than or equal to each of the following values:

(i) (a) *if the primary element has analogue movement*—The largest of the volumes corresponding to 2 mm of its scale or to 1/5 of the value of the graduation on that scale,

(b) *if the primary element has digital movement*—Volume corresponding to two units of graduation;

(ii) twice the periodic variation;

(iii) the volume which, in normal usage, corresponds to the play or slip in the transmission of the motion of the measuring device to the primary element of the indicating device.

(b) The minimum delivery should take into account, where necessary, the influence of auxiliary devices of the measuring assembly in accordance with the provisions of the Part realting to auxiliary devices and measuring assemblies.

(c) The value of the minimum delivery, determined by the application of the above rules, shall be of the form $1 \times 10^n$, $2 \times 10^n$ or $5 \times 10^n$ of authorised units of volume, where 'n' represents a whole number, positive or negative or is equal to zero.

**6. Maximum Flow and Minimum Flow :**

(a) The values of maximum and the minimum rates of flow of a meter shall be fixed in the light of the results of the model approval tests.

(b) The ratio between the maximum and the minimum rates of flow shall be not greater than 10 for ordinary meter, and not greater than 5 for meters for liquified gas.

(c) The meter shall be capable of operating in the vicinity of its maximum rate of flow for the period determined in the light of the results obtained in the model approval tests, without noticeably changing any of its metrological qualities.

**7. Effect of nature of Liquid, Temperature and Pressure :**

(a) The certificate of model approval of a meter shall indicate and fix:

(i) the liquid or liquids for the measurement of which the meter shall be used,

(ii) tempreature limits of the liquid measured if the limits are less than—10°C or more than + 50°C, and

(iii) the maximum operating pressure of the instrument.

(b) The models of meters submitted for approval shall be such that the variation of their errors due to :

(i) the maximum variations of the characteristics of liquids to be measured,

(ii) the maximum variations of the temperature of the liquids, and

(iii) the maximum variations in operating pressure, [these variations remaining within the limits fixed by the decision of approval referred to in sub-clause (a) above],

shall not exceed, for each of these factors, half the values of the maximum permissible errors specified in clauses 8 (a) and 8 (b) below.

**8. Maximum Permissible Errors on Initial Verification of Measuring Assembly :**

(a) Under the normal conditions of use and within the limits of usage specified in the decision of approval tests of the assembly, the maximum permissible errors on the initial vertification of the measuring assembly shall be as given below:

| *Quantities measured* | | *Maximum permissible errors* |
|---|---|---|
| From 0.02 to 0.1 litre | ± | 2 ml |
| From 0.1 to 0.2 litre | ± | 2 per cent of the quantity measured |
| From 0.2 to 0.4 litre | ± | 4 ml |
| From 0.4 to 1 litre | ± | 1 per cent of the quantity measured |
| From 1 to 2 litres | ± | 10 ml |
| 2 litres or more | ± | 0.5 per cent of the quantity measured |

(i) The maximum permissible error on the minimum delivery shall be double the error specified in (a) above, for the quantity corresponding to that delivery.

(ii) Whatever the volume measured, the maximum permissible error shall not be less than that permitted on the minimum delivery.

(b) Because of the special difficulties of control, the maximum permissible error as applied to:

(i) measuring assembly for liquified gas,

(ii) measuring assembly for liquids measured at a temperatare less than—10°C or more than +50°C,

(iii) measuring assembly with a minimum rate of flow of less than 1 litre per hour,

shall be double those specified under (a) above.

(c) If, in the flow range of the measuring assembly, the errors due to variations in the rate of flow, when a specified quantity is measured, are all in the same sense, one of these errors shall at least be less than or at the most equal to the greater of the following two values:

(i) half the maximum permissible errors specified above for the quantity measured, or

(ii) 0.3 percent of the quantity measured.

**9. Maximum Permissible Errors for Meter**

(When examined prior to initial verification of the measuring assembly for which it is intended)

When the initial verification of a measuring assembly is preceded by a preliminary examination of the meter to be used in that assembly and, if the liquid used for that examination is the same as that for which the meter is intended, the maximum permissible errors for the meter at the time of this preliminary examination shall be equal to the greater of the two values given below: half the maximum permissible error specified under clause 8 (a) or 8 (b) for the measuring assembly, or 0.3 per cent of the quantity measured.

(i) If, due to any special difficulties of control, it is difficult to apply the above rules, the decision of model approval for that meter may increase the maximum permissible errors in the

preliminary examination referred to above, upto the limits specified under clauses 8 (a) and 8 (b) for the measuring assembly.

(ii) In other respects, the decision of model approval of the meter may reduce or modify or reduce and modify the values of the maximum permissible errors in the course of the preliminary examination in the case where such preliminary examination of a model of the meter is carried out:

when it is intended to measure many different liquids, with one of the liquids which the meter is intended to measure, or with a liquid different from that or those which the meter is intended to measure.

In the latter case, the decision of model approval may also specify the test rates of flows during preliminary examination at values other than those comprised between the maximum and the minimum authorised rates of flows.

**10. Markings :**

(i) Every meter shall bear the following markings :

*On the dial of the indicating device or on a conspicuous name plate :*

(a) the name and trade mark, if any, of the manufacturer, and his address,

(b) identification number and year of manufacture,

(c) number of model approval,

(d) nature of the liquid or liquids to be measured and the limits of kinematic or dynamic viscosity, if the indication of the nature of the liquids is inadequate to characterise their viscosity.

*Note* :—The kinematic viscosity shall be expressed in square metres per second or centistokes and the dynamic viscosity in newtonseconds per square metre or centipoises.

(e) maximum and minimum rates of flow,

(f) maximum operating pressure,

(g) temperature interval, if the liquid has to be measured at a temperature less than—10°C or more than +50°C,

(h) cyclic volume, and

*on the dial of the indicator device,*

shall be marked the units in which the volumes measured are expressed, and the minimum delivery.

(ii) These inscriptions shall be clearly legible and indelible under normal conditions of use of the meters.

(iii) The indicating device shall carry a designation and an identification number specific to that device.

(iv) If there is possibility of confusion, the direction of flow of liquid shall be indicated by an arrow on the casing of the measuring device.

(v) On dismountable meters for edible liquids, the identification number of the meter (or the last three digits of that number) shall be repeated on parts, the exchange of which may affect the result of measurement.

11. **Metrological Controls :**

(i) Every model of a meter of each manufacturer shall be submitted for approval tests to a laboratory specified by the Directorate of Weights and Measures,

(ii) Any modification or adjustments to an approved model, which may affect the results of measurement or regulatory conditions of use of the instrument, shall be prohibited.

(iii) In other cases, the manufacturer shall inform the Directorate of Weights and Measures.

12. **Seals of Control, Protection and Identification**

(a) The meter shall be provided with a place, which is visible without dismantling, on an essential part of the measuring or indicating device or on the housing of these devices to receive the Inspector's stamp.

(b) Meters shall be provided with devices which can be sealed and which prevent without damage to the protection marks affixed on these seals, access to parts which affect the results of measurement and permit, even partially, dismantling of the meter.

(c) This rule does not apply to meters of edible liquids dismantling of which is authorised under the decision of model approval.

(d) The decision of model approval may specify that a place shall be reserved on interchangeable parts of dismountable meters, for affixing the control seal, besides the identification number referred to in clause 10 (v).

## Part VI

## VOLUMETRIC CONTAINER TYPE LIQUID MEASURING DEVICE

1. **General ;**

The volumetric container type liquid measuring device consists of a bucket, a float and dip stick suitably graduated to indicate the volume of liquid at different heights in the bucket. The device is generally used for measuring the quantity of milk at milk purchasing centres.

2. **Nominal Capacities:**

(a) The unit of volume to be used shall be the cubic decimetre ($dm^3$) or, the cubic centimetre ($cm^3$).

*Note:*—The term litre (l) may be used as a special name for $dm^3$ and millilitre (ml) for $cm^3$.

(b) The volumetric container type liquid measuring device may be of one of the following capacities:

5 $dm^3$, 10 $dm^3$, 20 $dm^3$ and 50 $dm^3$.

(c) The value of the smallest graduation on the dipstick shall be of the form of $1 \times 10^n$, $2 \times 10^n$, or $5 \times 10^n$, where n represents a whole number, positive or negative or is equal to zero.

3. **General Requirements:**

(a) The bucket shall be made of suitable metal or alloy. The metal or alloy used shall be thermally stable, shall resist deformation. shall not have an unduly high co-efficient of cubical expansion, and shall not affect the liquid being measured in any way or be injurious to health. Some of the materials considered suitable are:

(i) mild steel,
(ii) stainless steel,
(iii) brass sheet,
(iv) copper sheet,
(v) aluminium alloy.

(b) The wall thickness of the bucket shall be so selected that the bucket will not get dented in normal use or become unusable after a few years in service.

(c) The bucket shall be free from surface defects and indentation. External and internal surfaces of the bucket made of mild steel, copper sheet and brass sheet shall be well tinned or tin plated.

(d) All seams shall be filled and smoothened to prevent the entrapment of air or liquid.

(e) The bucket shall be provided with a well formed and proportionate spout to facilitate pouring of liquid.

(f) The bucket shall be cylindrical in form. The bottom of the bucket shall be slightly concave to prevent change of shape due to the weight of the liquid. The maximum depth of the concavity shall not be more than 20mm.

(g) The bottom of the bucket shall be reinforced with angle strip of thickness not less than 5 mm.

(h) The upper edge of the bucket shall be reinforced round the circumference with a reinforcing band having a thickness not less than 5 mm.

(i) The bucket shall be provided with a suitable handle on the side opposite the spout.

(j) The top of the bucket shall be provided with a cross band across the diameter. The band shall have a groove of appropriate size and centrally located for inserting the dip stick.

(k) The float shall be suitably fabricated so as to be free from holes, pockets, dents or crevices. A dip stick shall be firmly welded on the upper centre of the float. The dip stick together with the float shall be so constructed that the device so formed maintains verticality in all positions.

(l) The dip stick shall have a rectangular cross-section of minimum dimension 20 mm × 10 mm. The graduations shall be made by engraving or other means on both sides of the vertical surface.

(m) The dip stick shall be graduated at suitable intervals throughout the nominal capacity of the measure.

(n) The graduation lines on the dip stick shall be clear, straight perpendicular to the axis of the stick and of uniform thickness not exceeding 1 mm.

(o) The dip stick shall be identified with the bucket by a number of identification, which shall be clearly legible and indelible.

4. **Tests:**

(a) The volumetric container type liquid measuring device shall be calibrated "to contain". (In capacity)

(b) For the purposes of calibration, a standrad test measure of appropriate capacity shall be used.

(c) Before calibration, the bucket shall be examined to ensure that it is clean and free from leakage.

(d) Measured quantities of test liquid from the test measure shall be poured in the bucket and the corresponding mark on the dip stick examined for checking accuracy.

5. **Permissible Error:**

The maximum permissible error shall not exceed the limits specified below:

| | |
|---|---|
| Marks representing upto half capacity | ± 2 percent of the capacity under measurement. |
| Marks representing more than half capacity and upto full capacity | ± 1 percent of the capacity under measurement. |

6. **Inscriptions:**

The following inscriptions shall be clearly and indelibly marked at a conspicuous place on the bucket or on a special plate securely attached to the bucket:

(a) nominal capacity,
(b) manufacturer's name or trade mark,
(c) the words for "edible liquids".

7. **Stamping:**

The stamp of verification shall be affixed on a plate or other device affixed with the bucket or dip stick";

8. **after Schedule VI, the following Schedule shall be inserted, namely:—**

"SCHEDULE VI-A

TEMPERATURE MEASURING INSTRUMENTS

**CLINICAL THERMOMETERS**

1. **General:** This Part deals with mercury-in glass clinical thermometers, with a maximum indicating device, intended to measure body temperature of human beings.

2. **Unit of temperature and graduation of scale:**

(a) The thermometers shall be graduated in degrees Celsius (Symbol: °C),

(b) The graduated scale shall include the range of temperature either from 35.0°C to 43.0°C or from 35.0°C to 42.0°C.

(c) The thermometers shall be graduated at every 0.1°C.

3. **Types:**

(a) Clinical thermometers may be of the solid stem type or of the enclosed scale type.

(i) In the solid stem type thermometers, the scale shall be marked directly on the tube of the capillary (stem).

(ii) In the enclosed scale type thermometers, the scale shall be marked on a scale—strip affixed length wise behind the capillary tube and the scale shall be fused into an airtight transparent tube which is joined to the mercury bulb and forms a protective sheath.

(b) The thermometers shall be provided with a maximum indicating device which prevents the mercury from descending by itself when the thermometer is cooled.

4. **Materials:**

(a) The bulbs of the thermometers shall be made from glass which possesses the properties indicating in Appendix A.

(b) When determined by the method indicated in Appendix B, the glass used for maximum indicating device, the capillary tube and the bulb shall extract not more than 310 micrograms of sodium oxide ($Na_2O$) per gram of glass.

(c) The scale-strip of the enclosed scale type thermometers shall be made of translucent meterial, metal or any other material having dimensional stability compatible with that of glass.

**5. Construction :**

(a) (i) The clinical thermometers shall be free from visible defects such as knots, cracks, bubbles and twisting of the borne.

(ii) In solid stem thermometers, the stem shall have a lens front so designed that when the thermometer is being read, the liquid column appears to be at least 1 mm wide.

(iii) The joint of the stem with the bulb shall be smooth.

(iv) The axes of the bulb and the capillary shall appear to be in one straight line.

(v) In solid stem thermometers, the stem sball be provided witb an opaque enamelled backing.

(vi) The capillary tube shall be sucb that the entire mercury column and its meniscus are easily and distinctly seen as of uniform widtb throughout the length of the capillary.

(b) The mercury used shall be pure and dry. The bulb, the capillary tube and the mercury shall be free from entrapped gases so as to ensure the proper working of the thermometers.

(c) The scale strip of the enclosed scale type thermometers sball be fixed firmly to the capillary tube at one end so as to prevent any mutual displacmeent of the two parts. Its position shall be indicated by an indelible mark on the sheath at the level with one of the numbered graduations of the scale.

*Note*:—This mark facilitates detection of any accidental displacement of the scale strip witb respect to the capillary tube.

(d) The sheath shall not contain any foreign matter and sball be free from entrapped moisture.

(e) After the tbermometer bas been heated to at lesat 37.0°C and then cooled down to a temperature below 35°C, the column shall fall below the lowest numbered graduation line only when the mercury is subjected to an acceleration of 600 $m/s^2$ at the level of tbe bottom of the bulb for two minutes.

**6. Graduation and numbering :**

(a) The interval between every degree celsius shall be not less than six mm.

(b) The graduations shall be uniform and distinct. They shall be engraved and filled with suitable pigment or printed indelibly. The lines shall be perpendicular to the axis of the thermometer. Their thickness shall be not more than one-fiftb of the graduation interval.

(c) Lines representing 35, 37, 40 degrees and the last degree shall be numbered in full while those representing other degrees may have unit place digit only. The numbers shall be engraved and filled with suitable pigment or printed indelibly.

7. Marking:

The following marking shall be engraved or printed indelibly on the scale strip of the enclosed scale type thermometers and on the stem of the solid stem type thermometers:

(i) the symbol "°C";

(ii) the manufacturer's name or trade mark;

(iii) batch number or code number.

8. **Metrological controls**:

(a) Approval of model:—

(i) Every model of the thermometer of each manufacturer shall be submitted for approval to a laboratory specified by the Directorate of Weights and Measures.

(ii) No change in an approved model shall be made without special authorisation.

(b) Verification—

All new thermometers shall be submitted to tests for initial verification.

9. **Sealing** :

The Inspector's seal shall be applied by a suitable method at such a place that it does not obstruct the normal use of the thermometers.

10. **Maximum permissible errors**:

After cooling to a temperature 20 ± 3°C the readings of clinical thermometers shall not be incorrect by more than ± 0.1°C upto 41.0°C and ± 0.2°C beyond 41.0°C.

11. **Time of response** :

The time required to attain the temperature from lowest graduated temperature to (40±0.1)°C shall not be more than 10 seconds, when placed in a constant temperature water bath at 40±1°C. No stirring during observation is to be done.

APPENDIX A

QUALITIES OF GLASSES FOR BULBS OF THERMOMETER

In order to be suitable for the production of bulbs of clinical thermometers the glass shall have qualities such that a thermometer, without a maximum indicating device, manufactured with that glass and heated in a boiling water bath for half an hour does not give a change of the zero by more than 0. 05°C.

APPENDIX B

# DETERMINATION OF HYDROLYTIC RESISTANCE OF GLASS GRAINS AT 98°C

1. **Apparatus:**

(a) Balance, accuracy $\pm$ 5 mg or better

(b) Burettes, 10 ml, graduated at 0.05 ml and 1ml or 2ml, graduated at 0.01ml.

(c) Cooling bath, of capacity sufficient to contain 1 litre of water for each flask used in the test.

(d) Conical flasks, 100 ml capacity, made of chemically resistant glass and pre-heated for filling to the base of the neck with water and heating as described in sub clause (e) below.

(e) Volumetric flasks, 50 ml capacity, made of chemically resistant glass with glass stoppers. It is advisable to select flasks with the graduation line in the lower half of the neck. Before use, each flask should be pre-tested by filling to above the graduation mark with water and heating to 100°C in the heating bath for 3 separate periods of one hour, using a fresh quantity of water in the flask each time.

*Note:*—Flasks made from vitreous silica may also be used in which case the pre-treatment is not required.

(f) Hammer, weighing about 1 kg.

(g) Mortar and pestle made of hardened steel.

(h) Pipette 25 ml.

(i) Sieves. A set of 200 mm diameter square aperture sieves, with stainless steel mesh, including

—a sieve (A) of 500 micrometres aperture,
—a sieve (B) of 300 micrometres aperture, and
—a sieve (C) of a convenient aperture between 600 and 1000 micrometres.

The cover, pan and especially the rings should be of stainless steel or lacquered wood.

The use of sieve (C) is recommended to retain larger pieces of glass and to avoid heavy wear on sieve (A).

(j) Thermometer, covering the range 90° to 100°C, capable of being read to an accuracy of $\pm$ 0.2°C.

(k) Heating bath, gas or electrically heated, thermostatically controlled, of capacity sufficient to contain 1 litre of liquid for each flask used in the test and capable of carrying out the heating cycle described in clause 4 below.

(l) Stoppered storage vessel.

2. **Reagents**:

(a) Analytical grade reagents shall be used throughout.

(b) Distilled water or deionized water, of high purity complying with the following requirements when tested immediately before use. It should be free from dissolved gases and heavy metals particularly copper shown on the dithiozone test; it should have a specific conductivity not exceeding $1 \times 10^{-4}$ S/m at 20°C and it should be neutral to methyl red.

(c) Citric acid 0.1 M. Dissolve 21.008g of solid citric acid ($C_6 H_8 O_7, H_2 O$) in water and dilute to one litre.

(d) Hydrochloric acid 0.01 N.

(e) Disodium hydrogen phosphate 0.2M. Dissolve 35.60g of solid disodium hydrogen phosphate ($Na_2 HPO_4, 2H_2O$) in water and dilute to one litre.

(f) Buffer solution pH=5.2. Add 92.8 ml of 0.1 M citric acid to 107.2 ml of 0.2 M disodium hydrogen phosphate.

(g) Methyl red indicator. Dissolve 25 mg of the sodium salt of methyl red in 100 ml of water.

3. **Preparation of Sample**:

Wrap the glass article as received, which should preferably have a wall thickness less than 1.5 mm, in clear paper and break it with a few hammer blows. Transfer at least 30g of pieces between 10 and 30 mm diameter to the hardened steel mortar, insert the pestle and drive sharply, once only, with hammer. Transfer the glass from the mortar to the upper sieve and shake the set of sieves briefly to separate the finer particles. Return to the mortar the glass remaining on sieves (A) and (C) and repeat the crushing and sieving until only about 10g of glass remain on sieve (C). Discard the glass from sieve (C) and from the receiving pan. Shake the set of sieves by hand for five minutes. Reserve for the test the grains which pass through sieve (A) but are retained on sieve (B).

At least 10 g of sample is required for the test. If it is necessary to crush and sieve more sample, it is essential that sample already obtained should be removed from sieve (B) and not sieved again.

After completion of all crushing and sieving, combine the samples, spread the grains on clear glazed paper and pass the magnet through them to remove any iron particle. Transfer the sample to the storage vessel and insert the stopper.

4. **Procedure**:

Transfer 2.00 g of the freshly prepared sample into each of three 50 ml volumetric flasks. Remove any adherent fine particles by swirling the grains six times in separate 30 ml portions of water, decanting as much water as possible after each washing. Fill the flask with water

to the graduation line and fill a fourth flask with distilled water to serve as blank test. Distribute the glass grains evenly over the flask bases of the sample flasks by gently shaking them, on the heating bath maintained at 98°±0.5°C so that they are immersed half way up the neck (a rack to hold the flask may be used). Increase the rate of heating so that the specified temperature is recorded within 3 minutes; after 5 minutes, when the flask has been warmed, insert the stopper. Continue the heating for 60 minutes from the time of immersion, maintaining the heating bath at 98°±0.5°C.

Remove the flasks from the bath, take out stoppers, place the flasks in the cooling bath, cool in running water and agitate contents of each flask thoroughly, then allow to stand until the grains settle and a clear supernatant solution is obtained.

By means of a pipette, transfer 25 ml of the clear solution from each flask into separate 100 ml conical flasks, add to each of these flasks two drops of methyl red indicator and titrate with 0.01N hydrochloric acid, matching the end-point with 25 ml of buffer solution plus two drops of indicator contained in a similar conical flask. Titrate all three sample solutions and the blank test solution in the same way.

5. **Expression of Results:**

Subtract the blank test value from each of the three values obtained from the samples and calculate the mean of the results per gram of sample; report this value and its equivalent in alkali extracted, calculated as micrograms of sodium oxide ($Na_2O$) per one gram of glass.

1 ml of 0.01 N hydrochloric acid=310 micrograms of sodium oxide.

*Note*:— If the wall thickness of the article used for the test is less than 1.5 mm, or if the density of glass is outside the range of 2.3 to 2.7g per ml at 20°C, these values should also be reported.";

(9) **after schedule IX, the following schedule shall be inserted, namely:**

"SCHEDULE IX-A

A. VANASPATI AND EDIBLE OILS

| *Net weight* | *Maximum limits of error* |
|---|---|
| 2 kg | ± 1.5% |
| 4 kg | ± 1.25% |
| 15.5 kg<br>16.5 kg | ± 0.6% |

B. ARTICLES SOLD IN POLYTHENE BAGS

1. **Food grains:** Pulses and other edible seeds.

Such as wheat, rice, ragi, pulses (masur dal, chana dal, chana whole, thur dal, moong dal, moong whole, bengal gram dal, bengal gram whole, green gram dal, green gram whole, white gram, rajma, dalia,

black gram dal, urad dal, urad dal whole), til seeds, peas, sago, coffee seeds, suji, fenugreek seed (methi), betelnut, cucumber seed, fennel, etc. etc.

| *Net weight* | *Permissible error* |
|---|---|
| Less than 100g | 3.00% |
| 101g to 500g | 2.00% |
| 501g to 1000g | 1.50% |
| Over 1000g | 0.75% |

**II Spices:**

Such as pepper, chillies, cuminseed, turmeric, black rye, coriander, cardamom, soonf (anise seed), mustard seeds, ajvayao, poppy seeds, kalaunji, abjosh, cinnamon, cloves, dry ginger, tamarind, raungi, garlic, chiranji, kush-kush, dalchini, sajura etc. etc.

| *Net weight* | *Permissible error* |
|---|---|
| Less than 100g | 3.00% |
| 101g to 500g | 2.00% |
| 501g to 1000g. | 1.50% |
| Over 1000g | 0.75% |

**III Powdered Articles:**

Such as chillies powder, pepper powder, turmeric powder, chana flour, arrow-root powder, bengalgram flour, coriander powder, amchoor garam masala, washing soda, wheat flour, coffee powder, soapnut powder table salt, nut powder etc. etc.

| *Net weight* | *Permissible error* |
|---|---|
| Less than 100g | 3.00% |
| 101g to 200g | 2.00% |
| 201g to 1000g | 1.50% |
| Over 1000g | 0.75% |

**IV Dry Fruits:**

Such as groundnut, dry coconut, dry grapes, cashewnuts, almond seeds, dry dates, etc. etc.

| *Net weight* | *Permissible error* |
|---|---|
| Less than 100g | 3.00% |
| 101g to 500g | 2.50% |
| 501g to 1000g | 1.50% |
| Over 1000g | 0.75% |

**V Other Items:**

Such as sugar, jaggery, kandsari, soapnut, chandani, camphor benjoin, chakka etc. etc.

| *Net weight* | *Permissible error* |
|---|---|
| Less than 100g | 3.00% |
| 101g to 200g | 2.00% |
| 201g to 1000g | 1:50% |
| Over 1000g | 0.75%". |

(10) **for Schedule XI, the following schedule shall be substituted, namely:—**

"SCHEDULE XI

(*See* Rule 17)

FEES PAYABLE FOR VERIFICATION AND STAMPING OF WEIGHTS, MEASURES AND WEIGHING AND MEASURING INSTRUMENTS

1. **Weights :**

(a) *Bullion Weights*

| *Denomination* | *Fee per piece* Rs. p. |
|---|---|
| 20 kg | 6.00 |
| 10 kg | 6.00 |
| 5 kg | 4.00 |
| 2 kg | 4.00 |
| 1 kg | 4.00 |
| 500 g | 1.50 |
| 200 g | 1.50 |
| 100 g | 1.50 |
| 50 g | 1.50 |
| 20 g | 1.50 |
| 10 g | 1.50 |
| 5 g | 1.50 |
| 2 g | 1.50 |
| 1 g | 1.50 |
| 500 mg | 1.00 |
| 200 mg | 1.00 |
| 100 mg | 1.00 |
| 50 mg | 1.00 |
| 20 mg | 1.00 |
| 10 mg | 1.00 |
| 5 mg | 1.00 |
| 2 mg | 1.00 |
| 1 mg | 1.00 |

(b) *Brass Weights (Other than Bullion)*

| | |
|---|---|
| 1 kg | 2.00 |
| 500 g | 1.00 |
| 200 g | 1.00 |
| 100 g | 1.00 |
| 50 g | 1.00 |
| 20 g | 1.00 |
| 10 g | 1.00 |
| 5 g | 1.00 |
| 2 g | 1.00 |
| 1 g | 1.00 |

(c) *Sheet Metal Weights (Other than Bullion)*

| *Denomination* | *Fee per piece* |
|---|---|
| 500 mg | 1.00 |
| 200 mg | 1.00 |
| 100 mg | 1.00 |
| 50 mg | 1.00 |
| 20 mg | 1.00 |
| 10 mg | 1.00 |
| 5 mg | 1.00 |
| 2 mg | 1.00 |
| 1 mg | 1.00 |

(d) *Iron and Steel Weights*

| | |
|---|---|
| 50 kg | 2.00 |
| 20 kg | 2.00 |
| 10 kg | 2.00 |
| 5 kg | 2.00 |
| 2 kg | 2.00 |
| 1 kg | 2.00 |
| 500 g | 1.00 |
| 200 g | 1.00 |
| 100 g | 1.00 |
| 50 g | 1.00 |
| 20 g | 1.00 |

(e) *Carat Weights*

| | |
|---|---|
| 500 c | 2.00 |
| 200 c | 2.00 |
| 100 c | 2.00 |
| 50 c | 2.00 |
| 20 c | 2.00 |
| 10 c | 2.00 |
| 5 c | 1.00 |
| 2 c | 1.00 |
| 1 c | 1.00 |
| 50/100 c | 1.00 |
| 20/100 c | 1.00 |
| 10/100 c | 1.00 |
| 5/100 c | 1.00 |
| 2/100 c | 1.00 |
| 1/100 c | 1.00 |
| 0.5/100 c | 1.00 |

2. **Capacity Measures including Storage tanks, Vehicle Tanks, Dispensing Measures and Peg Measures**

| *Capacity* | *Fee per piece* |
|---|---|
| 50 litres and above | Rs. 10 for the first 100 litres or part thereof plus Rs. 3 for every additional 100 litres or part thereof subject to a maximum of Rs. 1,000 |
| | Rs. |
| 20 l | 4.00 |
| 10 l | 4.00 |
| 5 l | 2.00 |
| 2 l | 2.00 |
| 1 l | 2.00 |
| 500 ml | 1.00 |
| 200 ml | 1.00 |
| 100 ml | 1.00 |
| 50 ml | 1.00 |
| 20 ml | 1.00 |
| 10 ml | 1.00 |
| 5 ml | 1.00 |
| 2 ml | 1.00 |
| 1 ml | 1.00 |
| 18.5 l | 4.00 |
| 60 ml | 1.00 |
| 30 ml | 1.00 |

3. **Length Measures**

(a) *Non-Flexible*

| | |
|---|---|
| 2.00 m | 2.00 |
| 1.00 m (ordinary) | 2.00 |
| 0.50 m (ordinary) | 2.00 |
| 1.00 m (graduated at every cm) | 4.00 |
| 0.50 m (graduated at every cm) | 4.00 |

(b) *Woven Metallic and glass fibre tape measures*

| | |
|---|---|
| 50 m | 6.00 |
| 30 m | 6.00 |
| 20 m | 4.00 |
| 15 m | 4.00 |
| 10 m | 4.00 |
| 5 m | 2.00 |
| 2 m | 2.00 |

(c) *Steel Tapes*

| | |
|---|---|
| 50 m | 10.00 |
| 30 m | 10.00 |
| 20 m | 6.00 |
| 15 m | 6.00 |

| Capacity | Fee per piece |
|---|---|
| | Rs. |
| 10 m | 4.00 |
| 5 m | 2.00 |
| 4 m | 2.00 |
| 3 m | 2.00 |
| 2 m | 2.00 |
| 1.5 m | 2.00 |
| 1 m | 2.00 |
| 0.5 m | 2.00 |
| (d) *Folding Scales* | |
| 1 m | 2.00 |
| 0.5 m | 1.00 |
| (e *Surveying Chains* | |
| 30 m | 6.00 |
| 20 m | 4.00 |

4. **Weighing Instruments (Other than Beam Scales of Classes C & D, Automatic Weighing Machines and Totalising Machines)**

| Capacity | Rs. |
|---|---|
| 400 t | 500.00 |
| 300 t | 400.00 |
| 200 t | 300.00 |
| 150 t | 250.00 |
| 100 t | 200.00 |
| 80 t | 180.00 |
| 60 t | 150.00 |
| 50 t | 150.00 |
| 40 t | 150.00 |
| 30 t | 150.00 |
| 25 t | 150.00 |
| 20 t | 150.00 |
| 15 t | 150.00 |
| 10 t | 100.00 |
| 5 t | 100.00 |
| 3 t | 50.00 |
| 2 t | 50.00 |
| 1500 kg | 30.00 |
| 1000 kg | 30.00 |
| 500 kg | 30.00 |
| 300 kg | 30.00 |
| 250 kg | 30.00 |
| 200 kg | 20.00 |
| 150 kg | 20.00 |
| 100 kg | 20.00 |
| 50 kg | 15.00 |
| 30 kg | 15.00 |
| 20 kg | 10.00 |
| 15 kg | 10.00 |
| 10 kg | 6.00 |

| Capacity | Fee per piece Rs. |
|---|---|
| 5 kg | 6.00 |
| 3 kg | 6.00 |
| 2 kg | 6.00 |
| 1 kg | 6.00 |
| 500 g and below | 4.00 |
| Person weighing machines (excluding bathroom scales) | 20.00 |
| **5. Beam Scales (Classes C and D)** | |
| 1000 kg | 30.00 |
| 500 kg | 20.00 |
| 300 kg | 20.00 |
| 200 kg | 10.00 |
| 100 kg | 10.00 |
| 50 kg | 6.00 |
| 20 kg | 6.00 |
| 10 kg | 6.00 |
| 5 kg | 4.00 |
| 2 kg | 4.00 |
| 1 kg | 4.00 |
| 500 g and below | 2.00 |
| **6. Automatic Weighing Machines.** | |
| Exceeding 10 t | 200.00 |
| Not exceeding 10 t but exceeding 1 t | 150.00 |
| Not exceeding 1 t but exceeding 50 kg | 100.00 |
| Not exceeding 50 kg but exceeding 10 kg | 60.00 |
| Not exceeding 10 kg | 40.00 |
| 7. Totalising Machines Each machine | 300.00 |
| **8. Volume Measuring Instruments** | |
| (a) Dispensing pumps Each pump | 100.00 |
| (b) Other instruments exceeding 100 litres. | Rs. 80 for the first 100 litres plus Rs. 75 for each additiona 100 litres or part thereof subject to maximum of Rs. 1,500. |
| | Rs. |
| Not exceedins 100 l but exceeding 50 l | 100.00 |
| Not exceeding 50 l but exceeding 20 l | 75.00 |
| Not exceeding 20 l | |

9. **Linear Measuring Instruments**

| | |
|---|---|
| (a) Taxi meters and Autorickshaw meters. Each Taxi meter or Autorickshaw meter | 10.00 |
| (b) Other Instruments exceeding 1000 m | Rs. 15.00 for the first 1,000 m plus Rs. 3.00 for every additional 100 meters or part thereof subject to a maximum of Rs. 75.00 |
| Not exceeding 1000 m but exceeding 500 m | 20.00 |
| Not exceeding 500 m but exceeding 100 m | 10.00 |
| Not exceeding 100 m | 6.00 |
| 10. Clinical Thermometer | 0.50 |
| 11. Water meter (domestic type) | 10.00 |
| 12. Electricity meter | 10.00 "; |

**(11) For scheduele XII, the following schedule shall be substituted namely;—**

"SCHEDULE XII

(*See* Rules 17)

FEES PAYABLE FOR ADJUSTMENT OF WEIGHTS, MEASURES AND WEIGHING AND MEASURING INSTRUMENTS

| *Description of work* | *Fees per piece of Instrument* |
|---|---|
| (1) Scrapping of lead from or adding lead to the adjusting hole in order to bring the weights within the limits of error | |
| (a) upto 1g | Nil |
| (b) above 1g | 25 P. |
| (2) Drilling of small holes upto 12 mm in diameter in weights, measures, beam scales etc. and filling them with lead to make the lead plug for Inspctor's stamp. | Re. 1 |
| (3) Drilling of lead from adjusting holes of weights or drilling of lead plugs in measures, beam scales etc. and refilling them | Re. 1 |
| (4) Filling of the surface of weights to remove the roughness due to bad casting or filing of the surface of the measures in one plane | Re. 1 |

*Note*.—In all cases where lead is required, the party who presents the weights, measures, and weighing and measuring instruments should provide lead."

**(12) For schedule XIV, the following schedule shall be substituted namely;—**

"SCHEDULE XIV

(*See* Rule 26)

LICENSING AND RENEWAL FEE FOR MANUFACTURERS, DEALERS AND REPAIRERS OF WEIGHTS AND MEASURES

| | | |
|---|---|---|
| (a) Manufacturer | —Rs. 150 per annum | (Calendar year) |
| (b) Dealer | —Rs. 100 per annum | (Calendar year) |
| (c) Repairer | —Rs. 100 per annum | (Calendar year)" |

By order of the Governor,

SARALA GOPALAN,

*Secretary to Government.*

**Explanatory Note**

(This note is not part of the notification but is intended to indicate its general purport.)

Difficulties are being experienced due to the absence of specifications for certain items in the Weights and Measures (Enforcement) Rules. For uniformity sake, the Directorate of Weights and Measures, Government of India, has prepared common specifications based on the recommendations of the O.I.M.L. to be incorporated in the State Weights and Measures (Enforcement) Rules.

The rates of stamping fees, adjustment fees and licence fees were fixed years ago and hence they require suitable revision. The rates proposed for stamping fee and licence fee are also in accordance with the rates suggested by Directorate of Weights and Measures. The adjustment fees is enhanced considering the quantity of work involved for the adjustments etc.

The above notification is intended to incorporate parallel amendment to the Kerala Weights and Measures (Enforcement) Rules.

Government of Kerala
1984

Reg. No. KL/TV(N)/12

# KERALA GAZETTE

## EXTRAORDINARY

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GOVERNMENT OF KERALA

**Taxes (G) Department**

ERRATUM

G.O. No. (Ms.) 164/84/TD. *Dated, Trivandrum, 17th October,* 1984.

**S.R.O. No. 1294/84.**—In the Kerala Foreign Liquor (Compounding, Blending and Bottling) Amendment Rules, 1984 issued under Notification IV—G.O (Ms.) No. 54/84/TD dated 24th March, 1984 and published as S.R.O. No. 291/84, at pages 4 to 5 of the Kerala Gazette Extraordinary No. 254 dated the 27th March, 1984, in rule 2, *for* "for transport, or transport" "*read* for export, or transport".

By order of the Governor,
U. Mahabala Rao,
*Commissioner & Secretary to Government.*

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